

4.0 Design Concept Alternatives

4.1 Introduction

This section includes background information explaining why particular alternatives are being evaluated and what issues are driving development of the alternatives. This chapter is divided into several sections to discuss the various project elements:

- Widening of I-17 at SR 101L TI
- I-17 mainline widening – Rose Garden Lane TI to New River TI (MP 214.5 to 232)
- I-17 mainline widening – New River TI to Black Canyon City TI (MP 232 to 244.5)
- Frontage Roads – Happy Valley Road to Carefree Highway
- Reconstruction of I-17/Table Mesa TI

4.2 Widening of I-17 at SR 101L TI

4.2.1 Introduction

This section of I-17 extends from Union Hills Drive on the south, above SR 101L and its frontage roads, to approximately Rose Garden Lane on the north.

In the northbound direction, two lanes plus an HOV lane (2+1) currently exist south of Yorkshire/Utopia, through the main body of the TI, and north of Rose Garden Lane, with auxiliary lanes added between entrance and exit ramps.

In the southbound direction, there are currently two lanes plus an HOV lane (2+1) from immediately north of Rose Garden Lane through the main body of the TI, with auxiliary lanes added between entrance and exit ramps. The E-S and W-S directional ramps from SR 101L combine and add three lanes to the existing 2+1 section for a short distance near Yorkshire/Utopia as shown in Figure 7, tapering to 4+1 to the south. Through the TI, lanes are twelve feet wide with eight-foot inside shoulders, ten-foot outside shoulders, and two-foot offsets to barrier.



Four bridges carry mainline I-17 over SR 101L and its associated frontage roads. The two southerly three-span structures cross the eastbound south frontage road (SFR), eastbound SR 101L, and westbound SR 101L. The two northerly one-span structures cross the westbound north frontage road (NFR). All four bridges are cast-in-place post-tensioned prestressed concrete box girders with a structure depth of 7'-3".

Three alternatives were developed for the I-17/SR 101L TI: (1) No Build, (2) Adding lanes without widening the existing bridges over the North Frontage Road, SR 101L, and the South Frontage Road, and (3) Widening bridges to accommodate added lanes. These alternatives are discussed in the following sections.

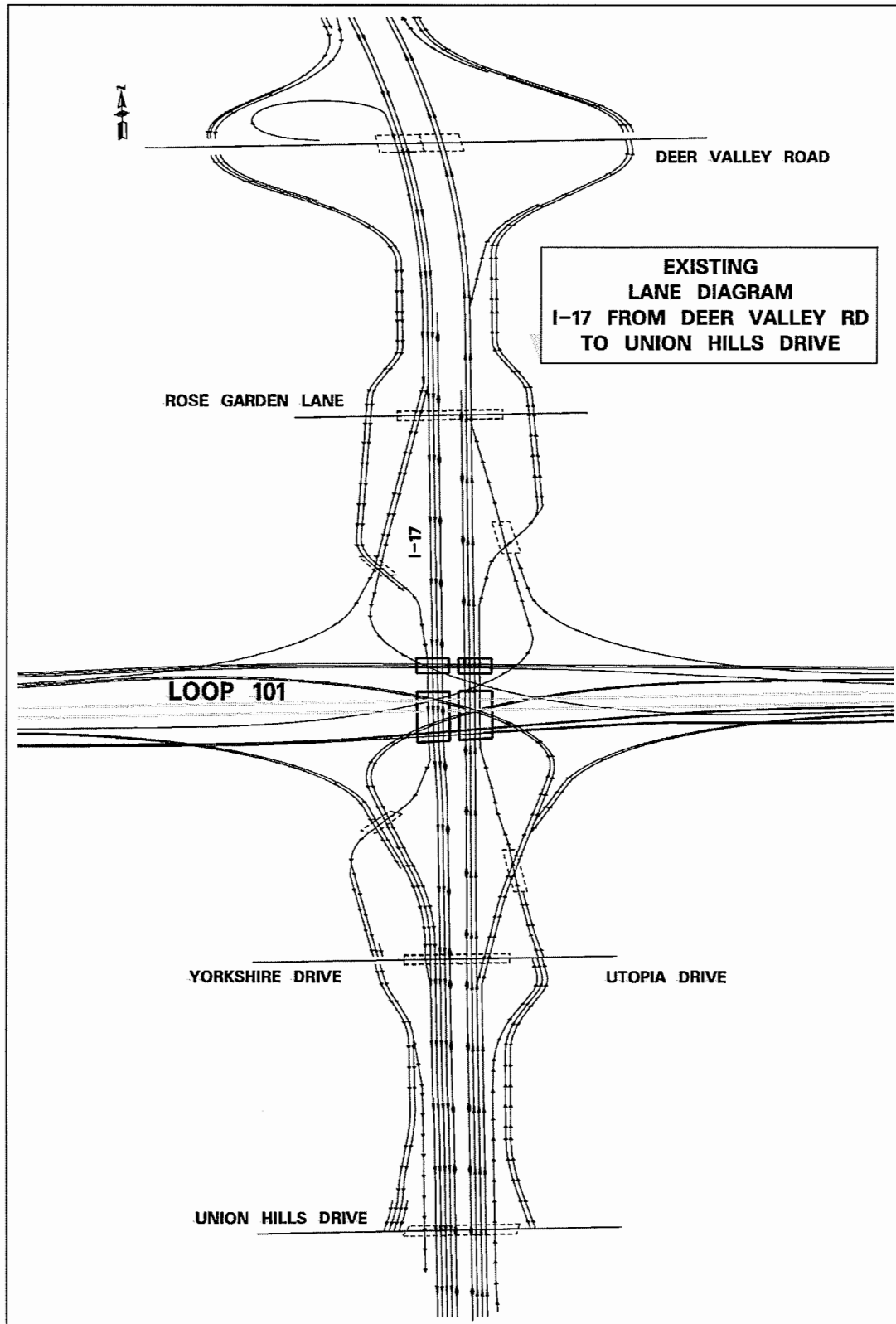
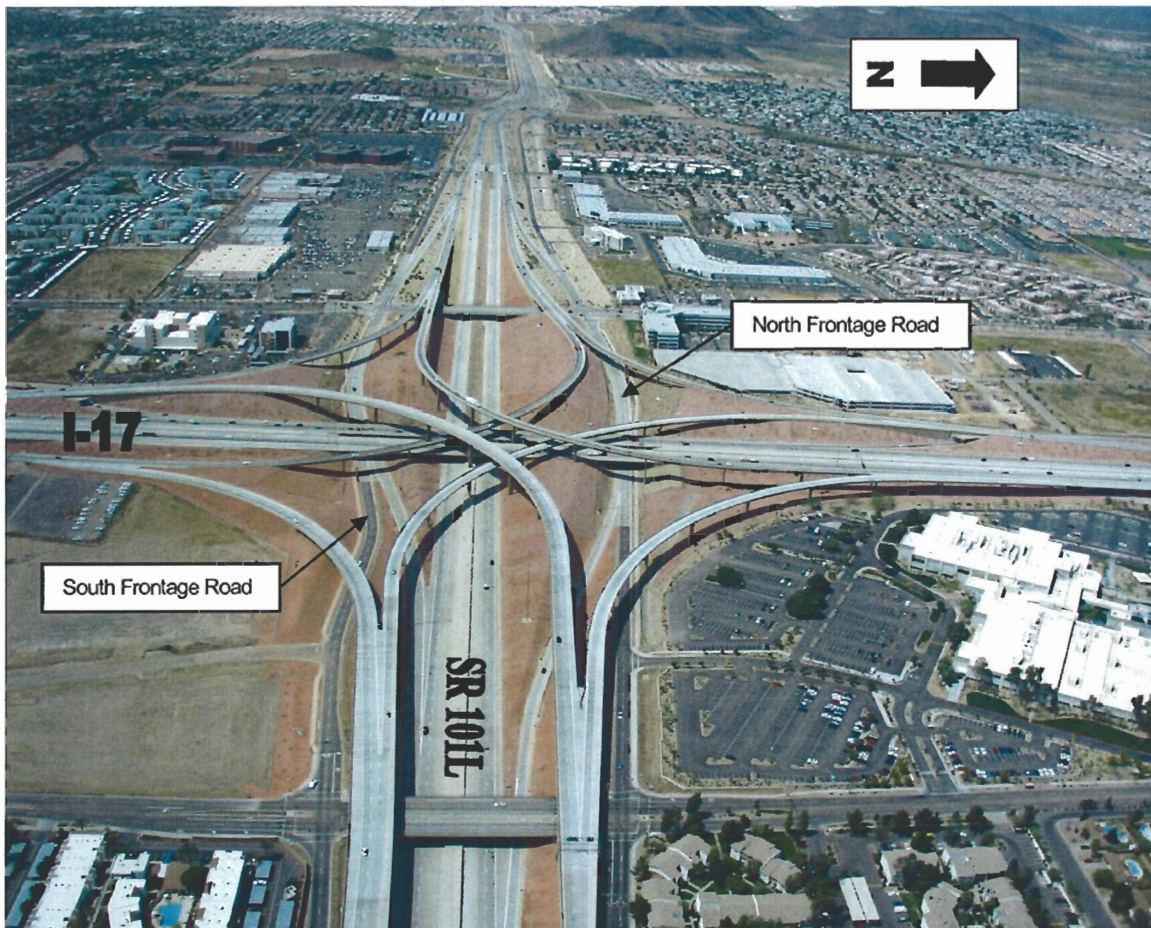


FIGURE 7 – LANE DIAGRAM – EXISTING CONDITION



4.2.2 Design Concept Alternatives Considered – I-17/SR 101L TI

4.2.2.1 No Build Alternative

The existing 2+1+1 section would remain with the No Build alternative. Lanes would not be added to the existing configuration. It is recommended that the No Build alternative be eliminated from further consideration since the existing lane configuration is inadequate to accommodate projected future traffic volumes.

4.2.2.2 Add Lanes Without Widening Existing Bridges

This alternative adds lanes to I-17 through the interchange without widening the existing bridge structures. Lane and shoulder widths are constrained by the existing bridge widths. From face of barrier to face of barrier, the minimum bridge widths are 69.7 feet northbound and 69.6 feet southbound. Design exceptions for lane and shoulder widths would be required with this alternative. One possible lane and shoulder combination in the northbound direction would include five 11-foot lanes, a three-foot inside shoulder, and an 11.7-foot outside shoulder. Because of the location of the end of taper, the wider southern bridge will allow somewhat greater widths than the northern bridge.

In the southbound direction, one possible lane and shoulder combination would include five 11-foot lanes, a three-foot inside shoulder, and a minimum outside shoulder of 11.6 feet. Except for the

outside shoulder, this section is held constant through the north and south bridges. The width of the outside shoulder varies as the overall bridge width tapers. The layout is shown in Figure 8.

4.2.2.3 Widen Existing Bridges to Accommodate Added Lanes

An alternative method of adding lanes to I-17 through the interchange is to widen the bridge structures over the South Frontage Road and SR 101L and the North Frontage Road, which results in wider lane and shoulder widths (see Figure 9). Because of the existing tapered sections, the widening can be uniform or tapered.

Uniform Widening Versus Tapered Widening

Creating a uniform-width roadway typical section on tapered bridges involves complementary "widening strips" that also taper (Figure 10). The structural and constructibility considerations of a tapering section are greater for a narrow widening strip than for a wide bridge deck. The structural and constructibility considerations of a tapering section are also greater for continuous multiple spans than for a simple span.

Uniform widening strips (prismatic structural cross sections) are easier to analyze, design, and construct. Prediction of their longer-term behavior – creep, shrinkage, deflection, etc. – is also more reliable. Uniform-width strips do, however, result in additional cost due to increased deck area, which could be used as added shoulder width.

There is room to implement uniform widening of three-span Structures #02178 and #02179, and one-span Structure #02181. However, because of the existing Ramp S-E pier, there is not enough room to implement uniform widening on the west side of the southbound one-span Structure #02180; this bridge requires a tapered widening strip.

Cast-In-Place (CIP) Concrete Construction Alternative

The existing bridges were built using CIP concrete construction. Maximum structural compatibility and optimum aesthetic compatibility are offered by using the same structural system for widening as the existing bridges (Figure 11). Bridge widening using CIP concrete construction would, however, require falsework over sections recently opened to traffic, and would result in impaired minimum vertical clearance during construction.

CIP concrete construction with falsework over traffic is somewhat less of a concern at the northerly bridges where there is some excess vertical clearance and lower north frontage road traffic volume. After widening over the NFR is completed, the NFR could be used as a detour to carry SR 101L westbound traffic and clear Span 3 of the southerly bridges.

Unfortunately, a similar approach cannot be used for eastbound traffic because the SFR passes under Span 1 and SR 101L eastbound passes under Span 2 of the same continuous three-span structures.

Precast/Prestressed (PC) Concrete Construction Alternative

Precast prestressed concrete girders are locally available in standard sizes from several producers. These PC girders are capable of spanning over 140 feet, but not up to 183 feet with conventional design and construction techniques.

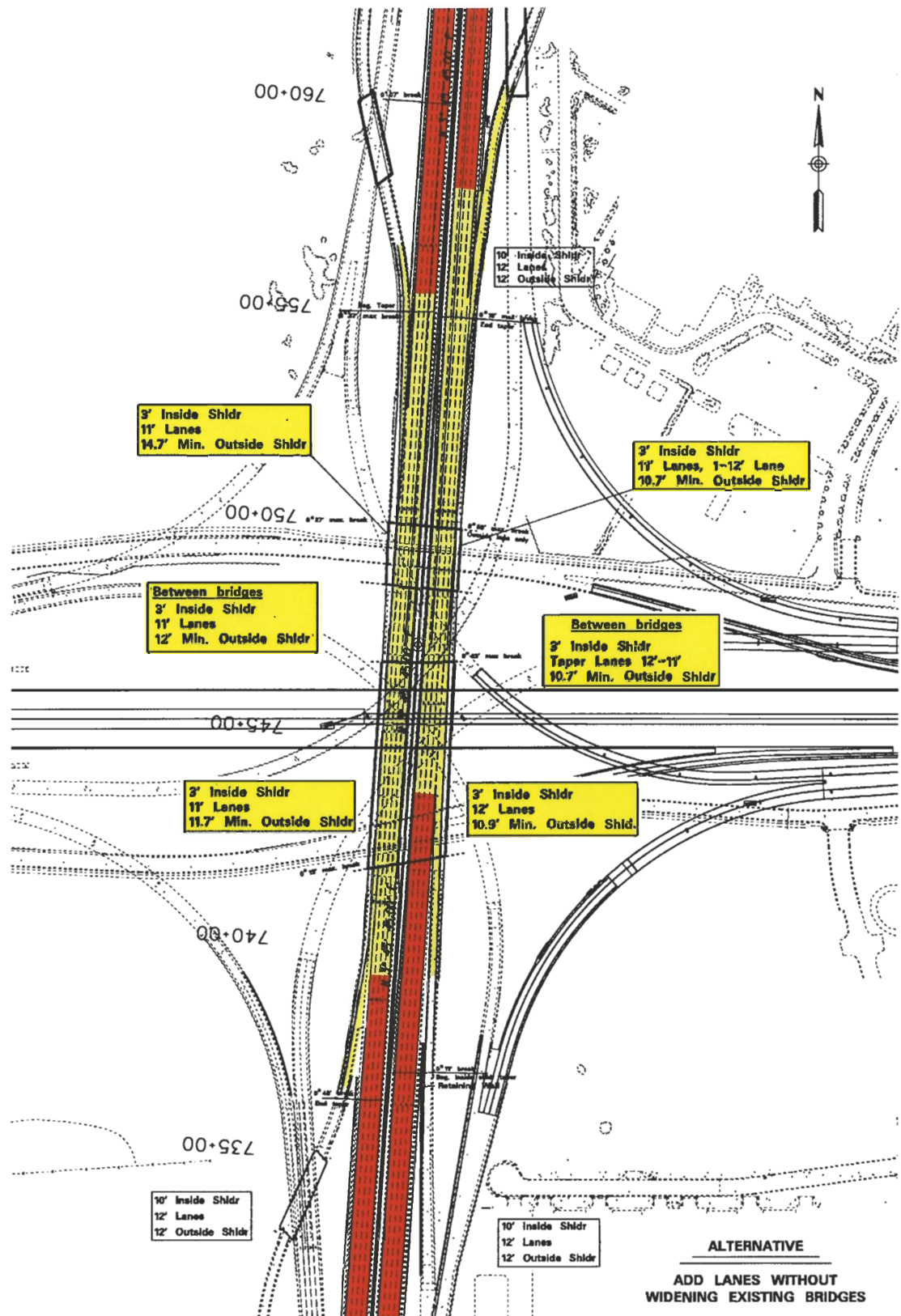


FIGURE 8 – LANE WIDTHS: ADD LANES WITHOUT WIDENING EXISTING BRIDGES

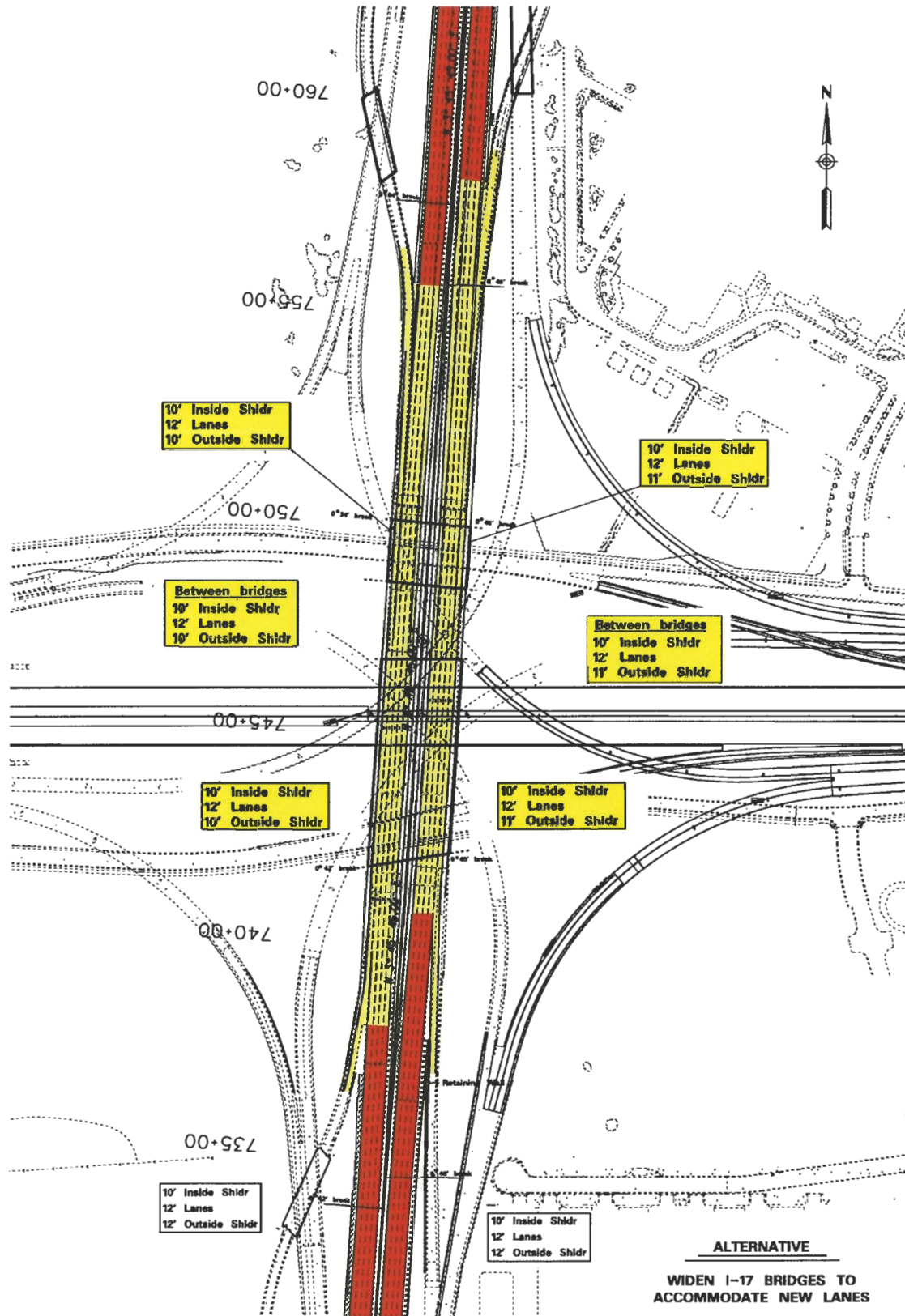


FIGURE 9 – LANE WIDTHS: WIDEN BRIDGES TO ACCOMMODATE ADDED LANES

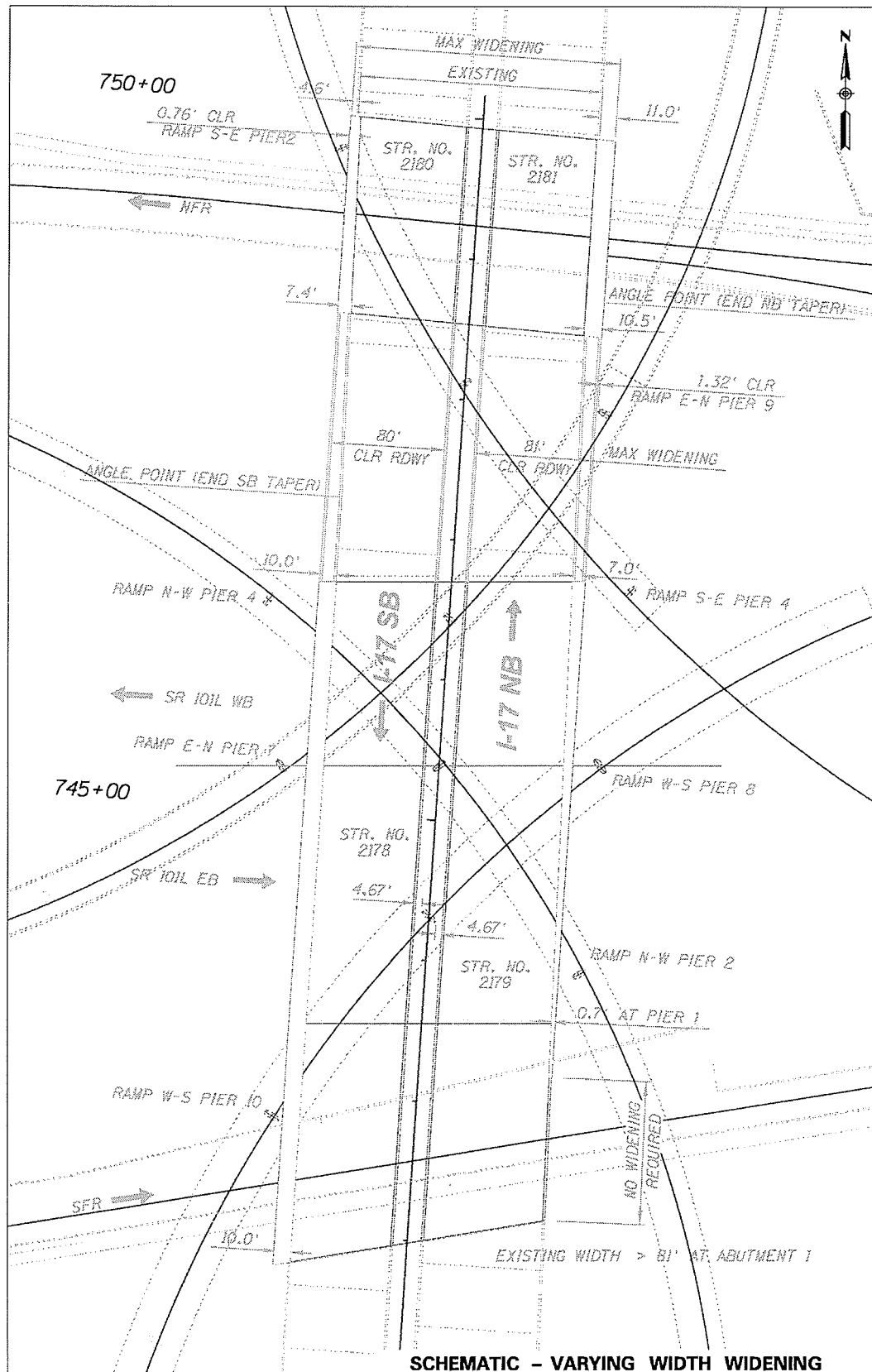


FIGURE 10 – TAPERED WIDENING OF STRUCTURES

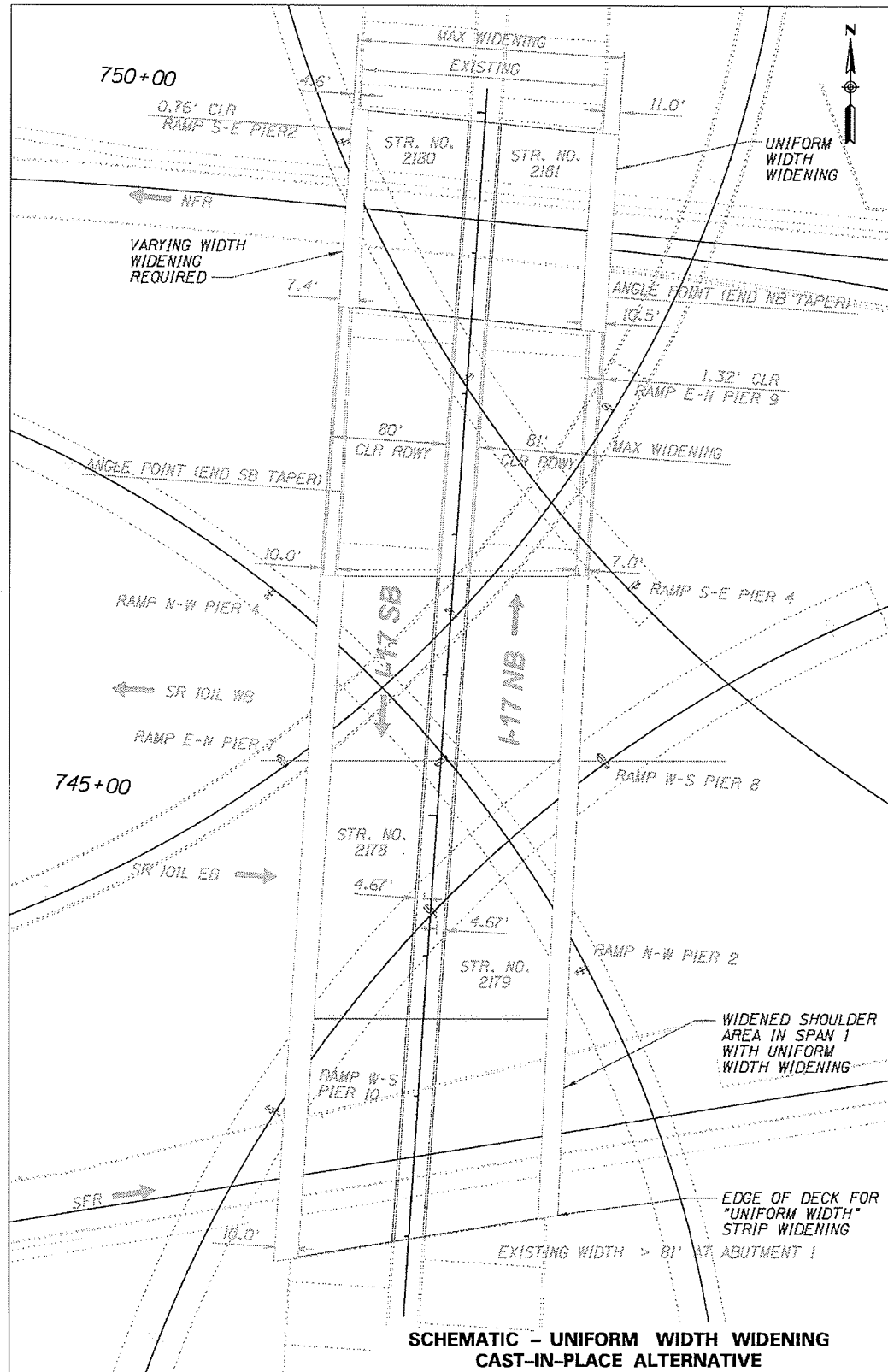


FIGURE 11 – UNIFORM WIDENING – CAST-IN-PLACE CONSTRUCTION

The northerly one-span bridges can be widened using standard AASHTO Type VI girders with a matching simple span of 140 feet. For net widening within the available space range from about 5 feet to 12 feet, two girders will suffice on each widened side.

Hybrid Construction Method – Partial CIP and Partial PC

The southerly three-span bridges can be widened using a combination of standard AASHTO Type VI girders, CIP pier tables, and post tensioning (Figure 12). The existing span arrangement is approximately [155'+183'+132']. This arrangement can be replicated via hybrid construction as follows:

[131' PC + 48' CIP + 135' PC + 48' CIP + 108' PC]

Precast sections are employed over traffic. Balanced cantilever CIP pier tables, extending 24 feet back station and 24 feet ahead station of the piers, are employed to make up the difference. On the west side of Structure #02178, the CIP pier table must be extended further south of Pier 1 because the west edge-of-deck length is considerably longer due to skew.

For this potential scenario, it is recommended that the CIP pier table falsework be designed and situated to support the PC girder ends. This facilitates tendon duct couplings and placement of closure concrete without support brackets and "dapped" girder ends. It also facilitates setting of girders in any order without concern for cantilever counterbalance sequencing.

A variation of the above hybrid construction involves end spans over the SFR and SR 101L westbound designed as CIP frames, with cantilever overhangs beyond the piers. The center span, reduced in length by the cantilever overhangs, is designed as "drop-in" PC girders. This technique was used for SR 101L overpass structures at Cave Creek Road and Tatum Boulevard, both built over traffic. For this I-17 application, support hinges, bearing pads, and expansion joints would not be compatible with the existing continuous bridges. The end frames and drop-in span must employ closure concrete and post-tensioned continuity tendons for continuity and compatibility with the existing three-span continuous bridges.

Additional Constructibility Issues

General. Construction ingress and egress are difficult in the core of the TI. All four roadway components – the SFR, SR 101L eastbound, SR 101L westbound, and the NFR are one-way facilities in a depressed section. All four facilities are required to access all of the substructure locations. The northerly structures only impact the NFR and access may be relatively easy from 27th Avenue. Pier 2 of the three-span bridges is the most difficult because it requires access from the median-side lanes of SR 101L.

Substructure. If drilled shaft foundations are used, benches are required for drilling rigs. The rigs have tall masts. There are 12 substructure locations, about half of which are near Level 3 or Level 4 flyover bridges.

Superstructure. If PC girders are used, delivery of the girders is best accomplished by using the outside lane and shoulder of I-17. Delivery via SR 101L is possible, but requires rotating the girders about 90° for setting. In either case, lifting and setting of AASHTO Type VI girders 130~140 feet long requires large cranes, usually one at each end. The cranes have very large booms/masts and are typically parked along the *Feature Under* roadway. There are 16 girder end locations, about 1/3 of which are situated very near or directly under the Level 3 flyover structures and about 1/3 of which are situated very near or directly under the Level 4 flyover structures. The feasibility of unloading and setting girders in the proximity of the flyover bridges should be assessed during final design. Crane size, crane location, boom/mast length, boom angle and other maneuvering factors need to be considered. If the girders cannot be suspended into position, a more elaborate installation, like launching from one end, may be required. Evaluation of the PC concrete construction alternative depends upon the outcome of such a study.

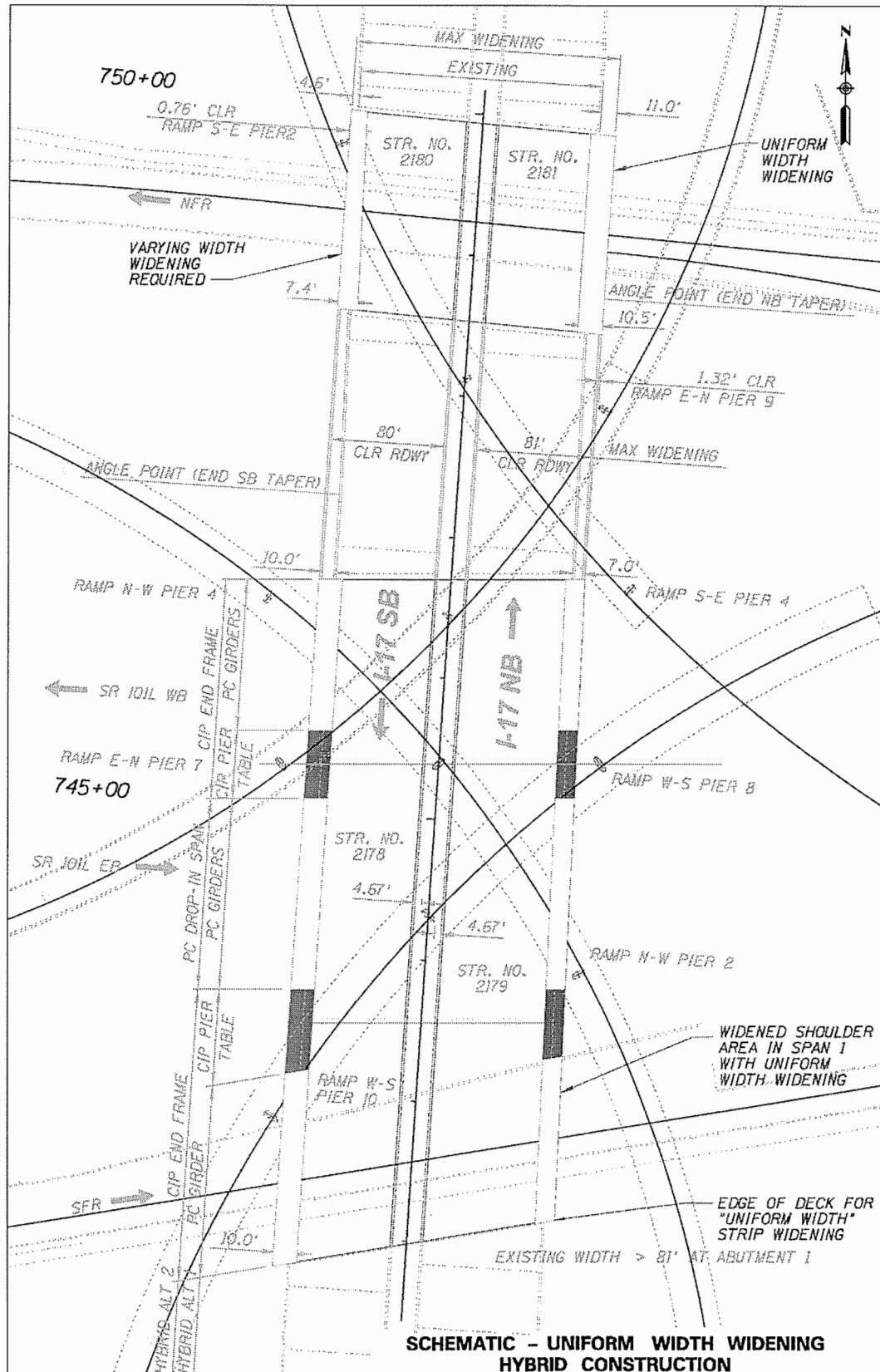


FIGURE 12 – UNIFORM WIDENING – PARTIAL CIP AND PARTIAL PC CONSTRUCTION

4.2.3 Recommended Alternative – I-17 at SR 101L TI

It is recommended that bridge widening be performed using *uniform width* widening instead of tapered/flared widening and *CIP construction* instead of precast, hybrid construction. This is possible for three of the four bridges – varying width widening appears inevitable for Structure #02180. Predictability of short-term and long-term behavior is maximized and compatibility is optimized when the widening structure type and construction method match the existing. There is not an abundance of historical data available locally to assess the cost difference. Additional constructibility issues need to be addressed during final design, particularly in light of the prevailing SR 101L and frontage road traffic characteristics at the time of scheduled widening construction.

The addition of a northbound lane to I-17 through the SR 101L TI should be accomplished by widening I-17 south of the northbound exit ramp to eastbound and westbound SR 101L. Based on limited mapping, it is proposed that I-17 be flared approximately 800 feet south of Yorkshire; however, when additional mapping is obtained during final design, an attempt should be made to add the lane farther south if possible.

In the southbound direction, it is recommended that the added lane be terminated south of Union Hills Drive. The directional east-to-south and west-to-south ramps from SR 101L combine to add three lanes to the mainline at Yorkshire, for a total lane count of 6+1 (Figure 13). With approximately 1000 feet between lane drops and 70:1 tapers for the lane merges, the southbound section will match the existing 4+1 section approximately 500 feet south of the Union Hills Drive centerline. To increase the width available for the mainline lanes, it is recommended that the "bypass" ramp/frontage road carrying traffic from the Yorkshire entrance ramp across the Union Hills bridge be diverted through the ramp intersections with Union Hills Drive. The additional width on the I-17 bridge over Union Hills would then be converted to mainline width. A southbound right-turn lane on the exit ramp at Union Hills Drive should be added to improve the LOS on the ramps.

4.3 Mainline Widening– Rose Garden Lane TI to New River TI

For the proposed cross section of five lanes in each direction plus an HOV lane from Rose Garden Lane to Carefree Highway (State Route 74), a roadway width of 99-109 feet is required (including median barrier). For the proposed urban cross section of four lanes plus an HOV lane in each direction from Carefree Highway to the New River TI, a roadway width of 85-97 feet is required. From the columns in Table 7 entitled "NB I-17 Bridge Width" and "SB I-17 Bridge Width", it is evident that all of the mainline bridges must be widened or replaced to accommodate the proposed roadway width. As shown in the columns entitled "Avail. Span Width NB" and "Avail. Span Width SB", several of the underpass bridges will not accommodate the proposed section. These TI structures include Pinnacle Peak Road, Happy Valley Road, and Carefree Highway; all will require reconstruction to accommodate the recommended widths.

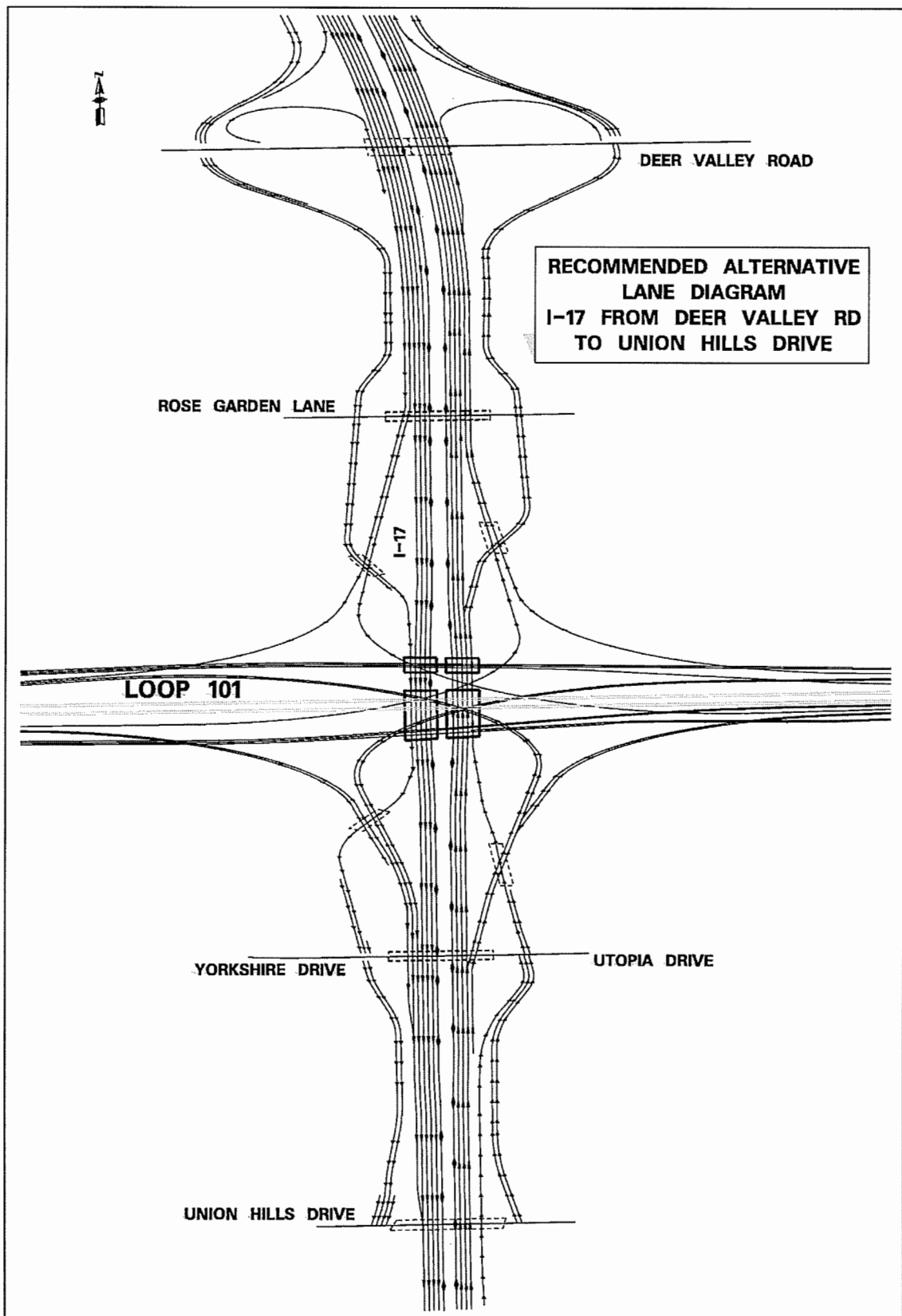


FIGURE 13 – LANE DIAGRAM – RECOMMENDED ALTERNATIVE

Two widening alternatives were considered in addition to the No Build alternative: widen I-17 to the inside and widen I-17 to the outside. Inside widening would consist of paving from the median centerline outward. In many roadway sections, the proposed roadway section would cover the median area, the existing pavement, and some width outside of the existing pavement. Widening to the outside would consist of adding pavement only to the outside of the existing pavement.

4.3.1 No Build Alternative

The existing four-lane divided highway section would remain in place in the No Build alternative. No right-of-way would be acquired and no impacts to adjacent businesses or utilities would occur. It is recommended that this alternative be eliminated from further consideration because the existing lanes will not accommodate projected traffic volumes.

4.3.2 Mainline Widening to Inside – Rose Garden Lane TI to New River TI

Typical sections developed for the Inside Widening scenario (Figures 14-18) reflect a 5+1 lane arrangement from Rose Garden Lane to the interchange with Carefree Highway, then 4+1 north to the New River TI. New pavement is added to fill in the median area and to the outside of the existing lanes as necessary to provide the required pavement width.

In sections with a 60-foot median (north of Rose Garden Lane to Happy Valley Road), the 5+1 inside widening scenario paves the 30-foot median, 38-foot existing pavement, and 41 feet to the outside of the existing pavement, for a total of 109 feet. In areas with a 76-foot median and a 4+1 cross section, the 38 feet median is paved, plus 38 feet of existing mainline pavement, plus 21 feet to the outside of the existing pavement, for a total of 97 feet, including median barrier and auxiliary lanes. A two-foot HOV buffer will be included from approximately Rose Garden Lane to the termination of the HOV lane at the New River TI.

North of Rose Garden Lane to North of Deer Valley (Sta. 780+00 to 800+00, MP 215.6 to 216.0)

One-way frontage roads exist on both sides of I-17. With the addition of barrier between the mainline and the frontage road, the west frontage road will not be disturbed. The east frontage road will require relocation outward and the acquisition of approximately 18 feet of RW with the addition of barrier between the mainline and the frontage road and the standard 15 feet spacing between the frontage road and new RW line. No auxiliary lanes are provided since two SR 101L lanes are added northbound and two are dropped southbound under Rose Garden. An underground storm drain system will be required to carry onsite flows on both the east and west sides.

RW acquisition of 18 feet on the east side of I-17 impacts several properties, but appears to impact only one building: a mini-storage facility located against the right-of-way line at the south end of the northbound exit ramp to Deer Valley Road.

Onsite runoff generated on the east and west side of I-17 will be collected and conveyed to the SR 101L drainage system via closed conduit storm drains. The storm drains will be sized for the 10-year onsite storm event.

The ultimate highway typical section constructs a 15-foot swale along the east right-of-way. The swale will be approximately 1-1.5 feet in depth. The swale will outlet via area inlets to the closed conduit. The closed conduit will outlet to the SR 101L drainage system. This drainage system will ensure that the ultimate onsite storm water runoff will not exceed the existing condition storm water runoff in this section.

The Deer Valley Road mainline bridges must be widened a total of 62 feet in order to accommodate the added lanes. Widening will include both median infill and outside widening.

North of Deer Valley to Scatter Wash (Sta. 800+00 to 830+00, MP 216.0 to 216.6)

Scatter Wash crosses beneath I-17 in two sets of culverts, located approximately 900 feet apart, midway between Deer Valley Road and Pinnacle Peak Road. Scatter Wash is the southern limit of and the outfall for a proposed large concrete-lined channel from Skunk Creek that will carry off-site runoff. A 6.7-acre detention basin is proposed on the west side of I-17 north of Deer Valley Road.

A full-width typical section is recommended for both sides of I-17 in this section. The east frontage road will be separated from the mainline by 30 feet (including shoulder widths) and from the new R/W line by 15 feet. Relocation of the east frontage road will be required. In order to minimize R/W acquisition and impacts to adjacent properties, the east side will require a pipe to carry onsite flows. Approximately 30 feet of new R/W will be required on the east side, impacting approximately ten properties.

On the west side, the frontage road will be separated from the mainline by a wide, shallow drainage channel. Approximately 60 feet of R/W will be required on the west side, impacting approximately ten properties. Auxiliary lanes will be provided in both directions from Deer Valley to Pinnacle Peak Road.

Scatter Wash to Skunk Creek (Sta. 830+00 to 955+00, MP 216.6 to 218.9)

This section of I-17 begins midway between the Deer Valley and Pinnacle Peak TIs, and extends north beyond the Happy Valley TI, to Skunk Creek, located approximately 1000 feet north of the Jomax Road alignment extended. The concrete-lined channel for offsite drainage on the east side is added in this section.

With the east frontage road offset 18 feet from the mainline, and the channel and 24-foot maintenance area added, the new right-of-way requirement will be 79-91 feet, with R/W required from approximately eight properties, including the USAA property in the northeast quadrant of I-17/ Happy Valley Road.

ADOT is currently discussing reductions in R/W acquisition with two property owners on the east side of I-17 between Pinnacle Peak Road and Jomax Road. In order to maximize the developable property, Vestar (Pinnacle Peak to Happy Valley) and USAA (Happy Valley to Jomax) have requested that ADOT limit its R/W acquisition to 30 feet and construct a closed drainage system rather than a large drainage channel in these areas. USAA will construct a detention basin/storm drain system to collect and route storm water east of Norterra Parkway to the south and will provide 100-year 2-hour retention for the area located west of Norterra Parkway in accordance with City of Phoenix criteria. Vestar will be responsible for intercepting and re-routing all overland flow to prevent it from reaching ADOT R/W. A Memorandum of Understanding has been executed by ADOT with Vestar outlining the requirements under which the R/W will be reduced along the Vestar and the State Land parcels. A similar MOU is anticipated to be executed with USAA however, at the date of this publishing the agreement has not been completed.

On the west side, the frontage road will be separated from the mainline by a 52-foot channel for onsite flows. Up to 60 feet of R/W will be required on the west side, impacting approximately seven properties.

Auxiliary lanes are recommended in both directions from the Deer Valley TI to the Pinnacle Peak TI and from the Pinnacle Peak TI to the Happy Valley TI.

One-way frontage roads currently exist on both sides of I-17 from Deer Valley Road to Pinnacle Peak Road. Two-way frontage roads currently exist from Happy Valley Road to the Dixileta Drive alignment

extended, approximately three miles to the north. The City of Phoenix has committed to future design and construction of one-way frontage roads on both sides of I-17 between Pinnacle Peak Road and Happy Valley Road to fill in the gap. It is anticipated that the two-way frontage roads north of Happy Valley Road will be converted to one way and extended north to Carefree Highway as intermediate interchanges are constructed.

The Pinnacle Peak and Happy Valley Road TIs, with bridge openings of 67 and 68 feet, respectively, are inadequate to accommodate the proposed 5+1 section and must be reconstructed prior to the implementation of the ultimate I-17 section.

Scatter Wash is the southern limit of and the outfall for a proposed large concrete-lined channel from just south of Skunk Creek that will carry off-site runoff. The channel, which varies from 24 to 36 feet wide and three to six feet deep, will run parallel to and east of the east frontage road and the ramps at the Pinnacle Peak TI, but is proposed to cross beneath the ramps and run through the infield at the Happy Valley TI.

The east half of the highway will be drained via the concrete-lined channel located adjacent to the right-of-way. The channel will originate immediately south of Skunk Creek and extend to Scatter Wash. The capacity of the channel at Scatter Wash was estimated to be 1,200 cfs. The channel geometry is governed by the minimum channel depth required to outlet onsite flow to the channel, a minimum bottom width of eight feet, and 2:1 side slopes. The west side of the highway will be drained via a roadside channel located between the mainline and frontage road. Each system will outlet to existing and proposed Scatter Wash culverts.

The existing hydrologic models show a flow split at the Scatter Wash crossing of I-17. The existing culverts do not have capacity to pass the 100-year storm event. The combined capacity of the culverts (2 - 8' X 7' and 6' X 7') is approximately 1300 cfs. Approximately 720 cfs is currently diverted along the east side of I-17 to the Deer Valley TI. Storm water flows through the depressed Deer Valley TI and outlets in a southwesterly direction toward the SR 101L.

The proposed roadway improvements increase the amount of onsite storm water runoff and will reduce the hydraulic conveyance of the roadside channels along I-17. ADOT has discussed several design alternatives with the Flood Control District of Maricopa County (FCDMC) and the City of Phoenix (COP), including the following:

Alternative 1 - Construction of a "regional" offline detention/retention basin near the confluence of I-17 and Scatter Wash would detain the bypass currently breaking out of Scatter Wash. The 100-year 24-hour flood would be intercepted by the existing RCBC's and a proposed 2-6x7 RCBC. The bypass flows would be allowed to enter the detention basin via an appropriately-sized weir. The footprint of the basin would be approximately 6.7 acres and would have an average depth of six feet and 4:1 side slopes. The exact geometry of the detention basin may change during the final design process. Preliminary analysis determined that approximately 35 acre-ft of storage will be required. A six-foot average basin depth basin with 4:1 slopes would require a footprint of 6.7 acres. A new 2-6x7 RCBC would be required to convey the current bypass flows west to the proposed basin.

Alternative 2 - Construction of a small basin would be at the same location as the larger (Alternative 1) basin. The basin would be sized to ensure that the total amount of storm water runoff generated by the highway is detained and the existing condition flow patterns are maintained (bypass of 720 cfs). The size of this basin is contingent upon obtaining reliable and updated topographic data.

Alternative 1 is initially recommended since the required parcels are available and the potential positive impact for building the basin is great. If the funds do become available, building a retention basin system will benefit the region dramatically. FCDMC records indicate that there are 219 parcels affected

by the flooding (i.e. pay flood insurance). Although a set insurance rate does not exist for all properties, an average of \$500 per property per year would yield \$109,500 per year in savings, thereby saving \$2,290,000 over 20 years (current dollars).

Both alternatives require right-of-way in an area that is rapidly developing. ADOT is coordinating the proposed project with the FCDMC and the City of Phoenix to discuss cost-sharing opportunities for the "regional" basin. An IGA will likely be required. The cost of right-of-way will continue to escalate as development occurs along the highway corridor. Once the vacant parcels have been developed, the opportunity to construct the basin will be severely limited.

Skunk Creek to South of Dynamite (Sta. 955+00 to 992+00, MP 218.9 to 219.6)

The 5+1 typical section extends in each direction through this short segment. 28-foot frontage roads are offset by shallow 52-foot ditches for onsite drainage on both sides.

Approximately 56 feet of R/W will be required on the east side and 30 feet required on the west side, impacting approximately seven properties on the east side and nine properties on the west side.

Future auxiliary lanes are accommodated in both directions from Happy Valley to Jomax by the provision of a 12-foot outside shoulder and a ten-foot gap between the mainline and drainage channels.

The west half of the highway will be drained via a storm drain system to Skunk Creek. The east half of the highway will be drained via a channel between the mainline and the frontage road. These channels will be sized to accommodate onsite flow only. The CAP canal and Skunk Creek channelization protect the highway from flooding in this reach. The Skunk Creek crossing of I-17 was sized to pass the entire 100-year storm event generated by the watershed. Therefore, the proposed improvements to the CAP overchutes will not have a negative impact on the hydraulic operation of the crossing. Existing Skunk Creek mainline bridges will require both median infill and outside widening. Existing frontage road structures will need to be replaced in order to accommodate the proposed typical section.

South of Dynamite Boulevard to North of the CAP (Sta. 992+00 to 1040+00, MP 219.6 to 220.5)

From Dynamite Boulevard to the CAP, a new subdivision has been constructed on the west side of I-17 adjacent to the existing three-lane frontage road. To avoid impacts to the subdivision and its existing screen wall, barrier is recommended between the mainline and frontage road on the west side through this section. An underground storm drain system will be required to carry onsite flows on the west side. Space for an auxiliary lane will be available when the existing frontage road is converted to one-way and narrowed from 40 feet to 28 feet. No new R/W is required on the west side.

On the east side, a full typical section is recommended, including provision for a future auxiliary lane. A channel for onsite flows is provided. The existing right-of-way width on the east side varies from 140-156 feet. 52-68 feet of new R/W will be required, impacting approximately eight properties.

Existing CAP mainline bridges will require both median infill and outside widening. The existing southbound frontage road structure will require outside widening. The existing northbound frontage road structure will need to be replaced in order to accommodate the proposed alignment.

North of the CAP to Dixileta Drive (Sta. 1040+00 to 1063+00, MP 220.5 to 221.0)

Full typical section widths with ditches are employed for onsite drainage. Width for a future auxiliary lane in both directions, to be constructed when the City of Phoenix constructs its intermediate TIs, is

provided. Approximately 52 feet of new RW will be required on the east side, impacting two properties, and 60 feet required on the west side, impacting three properties.

The existing two-way frontage roads currently terminate at the Dixileta Drive alignment; however, the City of Phoenix has committed to future design and construction of one-way frontage roads from the Dixileta alignment north to Carefree Highway. When the planned intermediate interchanges are constructed at Dixileta Drive, Lone Mountain Road, and Dove Valley Road, and the frontage roads are converted to one way and extended north, a one-way frontage road system will be in place from SR 101L to Carefree Highway, a distance of approximately nine miles.

Dixileta Drive to Carefree Highway (Sta. 1063+00 to 1223+00, MP 221.0 to 224.0)

The 5+1 section will be extended north to Carefree Highway. Full widths are employed with ditches for onsite drainage and width for a future auxiliary lane in both directions.

Including widths for the City's future frontage roads, approximately 60 feet of new RW will be required on the east side and 52 feet on the west side. The land adjacent to I-17 in this section is currently undeveloped and by and large is owned by the State Land Department.

Linear detention basins/roadside channels will be constructed between the mainline and frontage road to collect and attenuate onsite flows. The ultimate storm water peak discharge (generated on ADOT right-of-way) should not exceed the existing condition peak discharge. A storm drain system will collect and convey storm water to an existing discharge location. Since the freeway is parallel to offsite flow in this area, the majority of this section of highway receives minimal offsite flow. The largest cross culvert in this reach is a 2 – 10' X 5' RCBC. The remaining cross culverts are small diameter pipes.

The City of Phoenix has preliminary plans for three new interchanges with I-17 through this segment. These new interchanges will be located at Dixileta Drive (MP 221), Lone Mountain Road (MP 222), and Dove Valley Road (MP 223). Although these TIs are in the long range plans of the City, no funding or schedules have been developed. The location of the future I-17/loop 303 system interchange will also influence which TIs will be constructed. The inside widening scenario will accommodate the addition of future interchanges along this segment.

A significant drainage issue exists at I-17 along the north side of the CAP aqueduct. The FCDMC recently prepared a report entitled *Skunk Creek Area Drainage Master Plan (ADMP)*. This study updates the existing hydrologic and hydraulic analyses for the watershed.

The report states the following: *"During the development of the hydraulic modeling for the Water Course Master Plan (WCMP), it was found that a breakout occurs at the CAP Canal and I-17. The breakout results from a backwater caused by limited hydraulic capacity of the Skunk Creek and Sonoran Wash overchutes at the CAP Canal. This breakout results in storm water being diverted west over I-17, and the CAP Canal being overwhelmed by discharges from floods more frequent than the 100-year event. This breakout has the potential to flood existing residences that were previously thought safe, and residences currently under construction. The overwhelming of the overchutes could result in failure of the CAP Canal embankments. The estimated peak discharge over I-17 during the 100-year storm is 6,400 cfs, or about 23 percent of the total flow in Skunk Creek. The estimated average flow depth over I-17 during the 100-year event is 2.5 feet."*

Results of the Skunk Creek ADMP were verified by a two-dimensional hydraulic model prepared as part of a report entitled *Floodplain Delineation Study for Skunk Creek Between the Central Arizona Project Canal and Happy Valley Road*, Tetra Tech, June 2002.

Results of the FCDMC studies significantly impact the proposed I-17 improvements. ADOT has met with the FCDMC and the City of Phoenix to discuss mitigation requirements for the CAP overchutes. FCDMC consultants are currently developing design alternatives to mitigate the flood hazard identified in the Skunk Creek ADMP. It is anticipated that the FCDMC may complete improvements to the overchutes prior to the I-17 project. The final designer should review the progress of the overchute improvements. If the capacity of the overchutes has not been increased at the time of design, then ADOT, FCDMC, and the City of Phoenix need to develop an implementation/cost sharing plan.

Carefree Highway TI to Anthem TI (Sta. 1223+00 to 1491+00, MP 224.0 to 229.1)

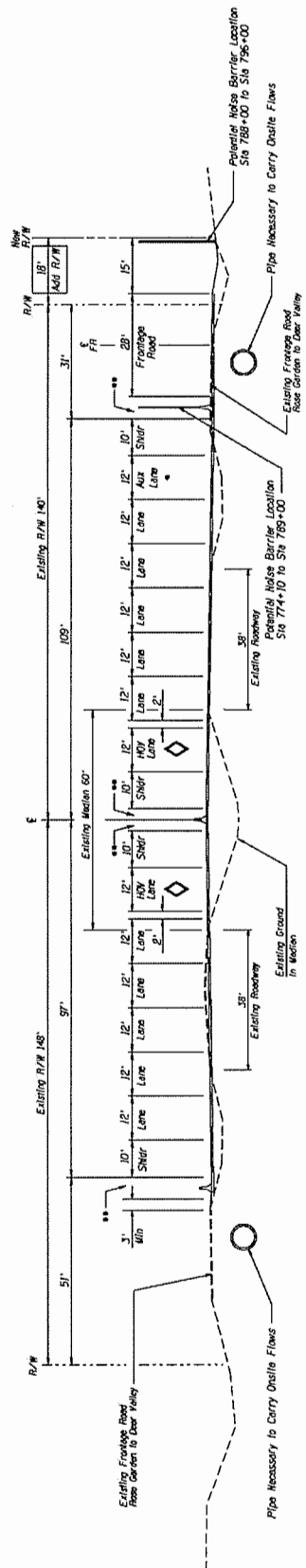
From the Carefree Highway TI north to the New River TI, a 4+1 section plus auxiliary lanes is recommended. This section includes the Pioneer Road TI, the (future) Daisy Mountain TI, and the Anthem TI. No new right-of-way is required to accommodate the proposed cross section. Auxiliary lanes constructed with the Daisy Mountain TI, will be maintained from the Pioneer Road TI to the Daisy Mountain TI and from the Daisy Mountain TI to the Anthem TI.

The Carefree Highway TI, with a bridge opening of 77 feet, is inadequate to accommodate the proposed 4+1 section. The Pioneer and Anthem TIs, with openings of 107 feet and 96 feet, respectively, will accommodate the proposed widening.

Anthem TI to New River TI (Sta. 1491+00 to 1610+00, MP 229.1 to 231.3)

From the Anthem TI north to the New River TI, a 4+1 section is recommended. New right-of-way is required to accommodate the proposed drainage channels. The existing frontage roads between Anthem Way and the New River TI will not be impacted nor modified; the drainage channels will be added to the outside of the frontage roads, requiring 34 feet of RW on the east side and 30 feet of RW on the west side.

Other Considerations. In certain sections of the corridor, the elevations of the northbound profile grade differ significantly from those of the southbound profile grade. South of Carefree Highway, the profiles should be modified so that a standard median barrier can be constructed.

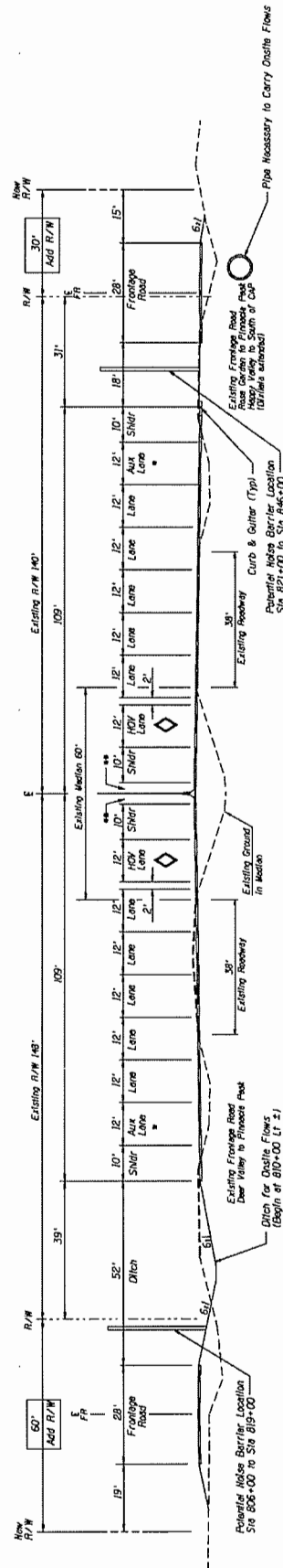


INSIDE WIDENING I-17 FROM ROSE GARDEN LN TO DEER VALLEY RD W/ FRONTAGE ROADS & NB AUX LN

5+1

STA 780+00 TO 800+00 ±
MP 215.8 - 216.0
I-17 LOOKING NORTH

- * Auxiliary Lane Added for NB Exit Ramp at Deer Valley Rd
- ** 2' Offset to Barrier



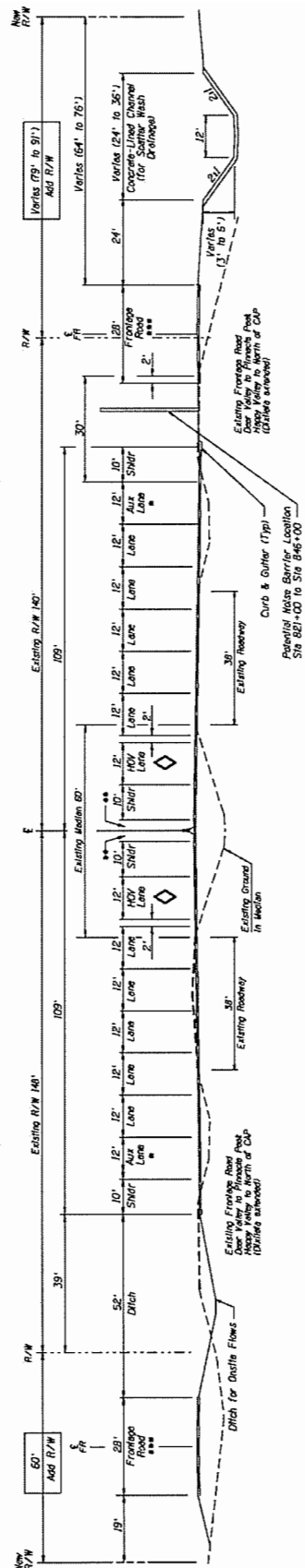
INSIDE WIDENING I-17 FROM DEER VALLEY RD TO SCATTER WASH W/ AUX LANES & FRONTAGE ROADS

5+1

STA 800+00 ± TO 830+00 ±
MP 216.0 - 216.6
I-17 LOOKING NORTH

- * Auxiliary Lane Added from Deer Valley Rd to Scatter Wash
- ** 2' Offset to Barrier

FIGURE 14 – TYPICAL SECTIONS – INSIDE WIDENING



INSIDE WIDENING I-17 FROM SCATTER WASH TO SKUNK CREEK W/ AUX LANES & FRONT. RDS

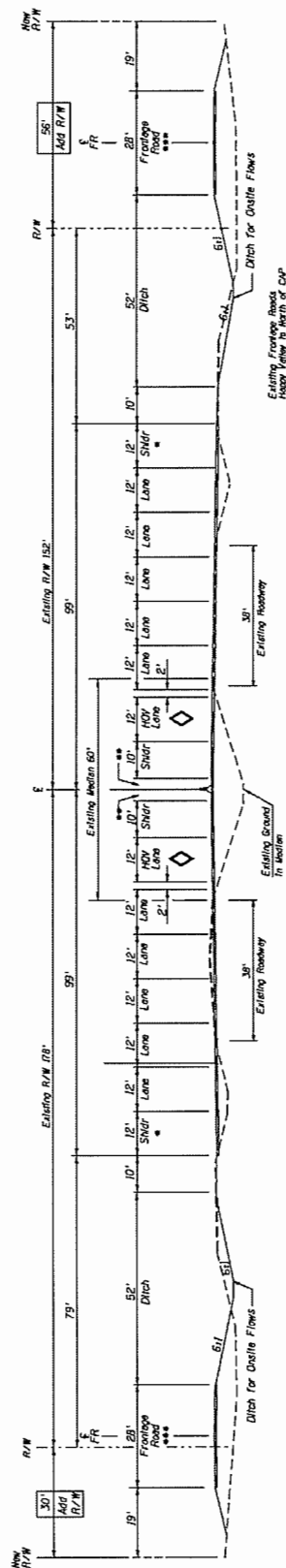
5+1

STA 830+00± TO 955+00 ±

MP 216.5 - 218.9

I-17 LOOKING NORTH

- Auxiliary Lane (added from Deer Valley Rd to Happy Valley Rd)
- 2" Offset to Barrier
- Frontage Roads (One-Way from Bioscience Road to Happy Valley Rd will be Constructed by City of Phoenix)



INSIDE WIDENING I-17 FROM SKUNK CREEK TO S OF DYNAMITE BLVD W/ FRONTAGE ROADS

5+1

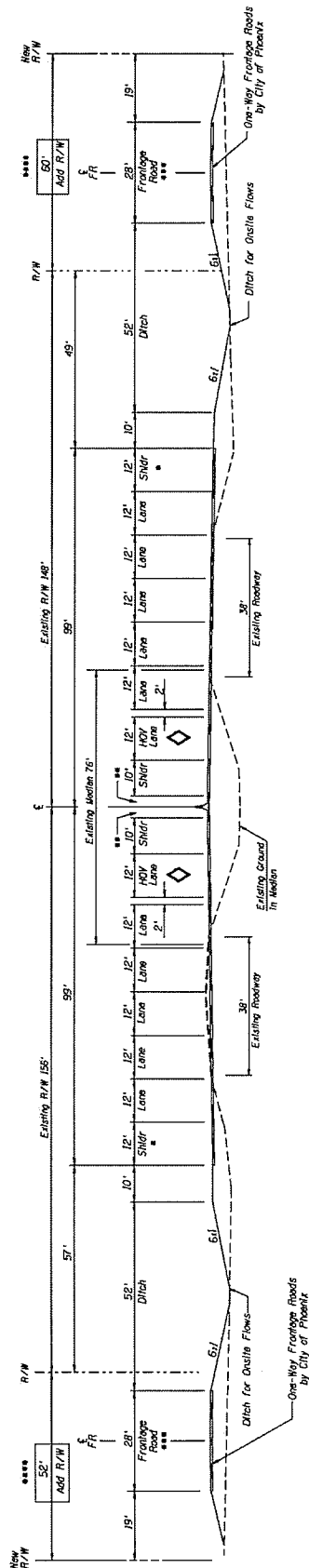
STA 955+00± TO 992+00 ±

MP 218.9 - 219.6

I-17 LOOKING NORTH

- Shoulder (Serves as Auxiliary Lane in Future)
- 2" Offset to Barrier
- Frontage Roads (Located to Accommodate Future Auxiliary Lanes)

FIGURE 15 –TYPICAL SECTIONS - INSIDE WIDENING (CONT.)

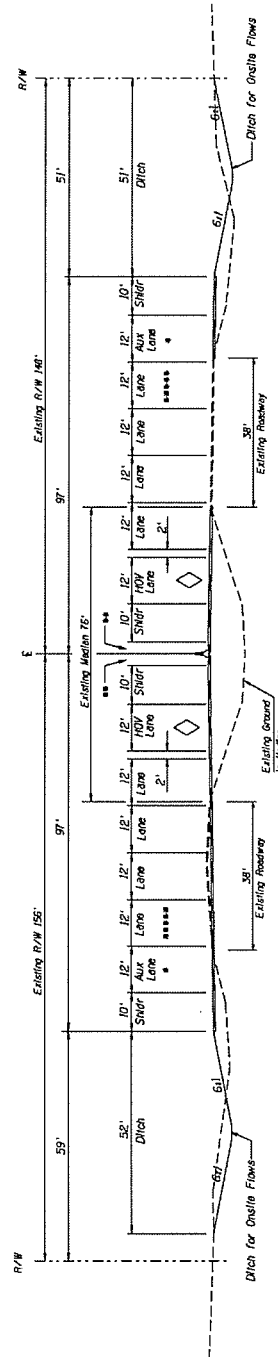


5+1

INSIDE WIDENING I-17 FROM DIXILETA RD TO CAREFREE HIGHWAY

STA 1063+00± TO 1223+00±
MP 221.0 - 224.0
I-17 LOOKING NORTH

- Shoulder (Shown as Auxiliary Lane in Future)
- 2' Offset to Barrier
- Frontage Roads (Located to Accommodate Future Auxiliary Lanes)
- The Right-of-Way for Frontage Roads will be Purchased by the City of Phoenix via Separate Easements and Easements. ADOT will Not Acquire R/W through This Segment



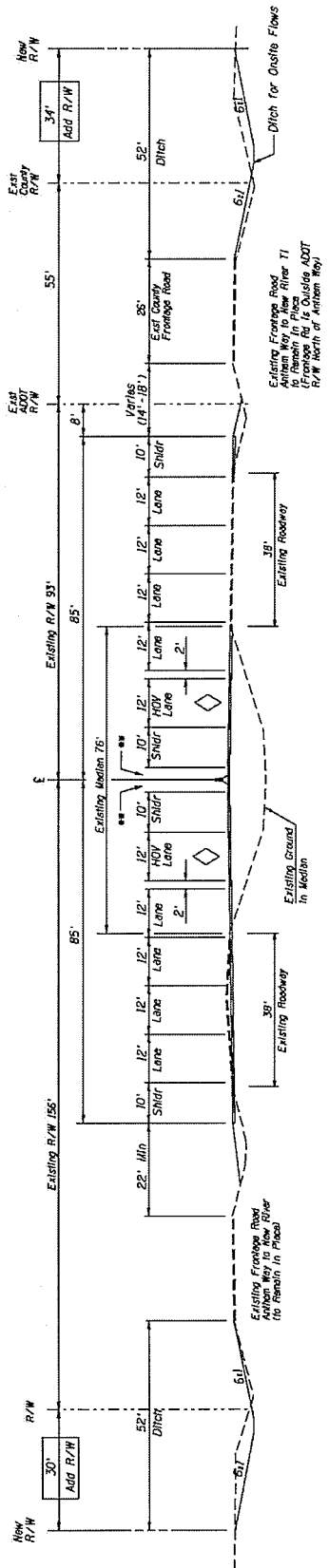
4+1

INSIDE WIDENING I-17 FROM CAREFREE HWY TO ANTHEM WAY

STA 1223+00± TO 1491+00±
MP 224.0 - 229.1
I-17 LOOKING NORTH

- Auxiliary Lane (Added between Carefree Highway and Pioneer Rd.)
- 2' Offset to Barrier
- Existing Auxiliary Lanes between Pioneer Rd and Anthem Way (part of the Dohy Mountain T1 Construction).

FIGURE 17 -TYPICAL SECTIONS - INSIDE WIDENING (CONT.)



4+1

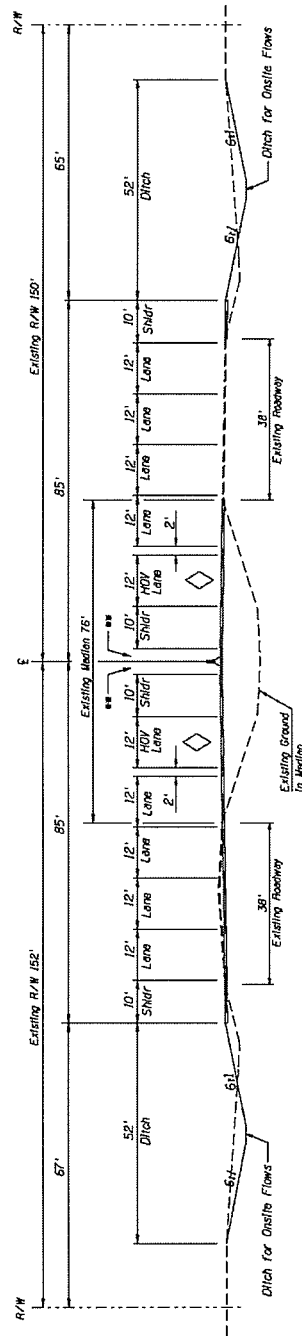
INSIDE WIDENING I-17 FROM ANTHEM WAY TO S OF NEW RIVER

2' Offset to Barrier

STA 1491+00 ± TO 1610+00 ±

MP 229.1 - 231.3

I-17 LOOKING NORTH



4+1

INSIDE WIDENING I-17 FROM S OF NEW RIVER TO NEW RIVER RD TI

2' Offset to Barrier

STA 1610+00 ± TO 1647+00 ±

MP 231.3 - 232.0

I-17 LOOKING NORTH

FIGURE 18 – TYPICAL SECTIONS – INSIDE WIDENING (CONT.)

4.3.3 Mainline Widening to Outside – Rose Garden Lane TI to New River TI

An outside widening alternative was considered for the roadway section between Rose Garden Lane and the New River TI (Figures 19–23). It was eliminated from further consideration for the following reasons.

Right-of-Way. Widening I-17 to the outside would require the acquisition of R/W in nearly all sections of the corridor. More properties would be impacted than by the inside widening alternative and larger areas required from all affected parcels. Relocation of the frontage road on the west side of I-17 between Skunk Creek and the CAP would be required, which would impact the noise/screen walls and likely the houses to the west. R/W acquisition could be avoided between Carefree Highway and Anthem Way only by the elimination of the drainage channels, which would require the addition of underground storm drains. In order to grade slopes, add drainage features, and accommodate utilities, additional R/W would be required for this alternative.

Structures. I-17 can be widened only to the outside at Rose Garden Lane, where the 120-foot available span includes the existing roadway width and provides space at the outside for future mainline widening.

Widening to the recommended width (both inside widening and outside widening) impacts several traffic interchange structures, including the Pinnacle Peak Road TI, the Happy Valley Road TI, and the Carefree Highway TI. All of these interchanges include structures that cross above the mainline. The structures were all constructed in 1964 and are four-span steel bridges with piers located adjacent to the existing outside shoulder of the mainline. Because of the shoulder piers, widening I-17 to the outside is not a viable option unless these three TIs are reconstructed. Reconstruction of the Carefree Highway TI is programmed for FY 2005; the remaining two interchanges have not yet been funded.

Mainline and frontage road overpass structures requiring widening and/or replacement include the Deer Valley TI OP, Skunk Creek, CAP Canal, Deadman Wash, New River Bridges, and New River TI OP.

Environmental. Because more right-of-way would be acquired, there is greater potential for disturbing cultural resources with this alternative. In addition, greater impacts to Corps of Engineers jurisdictional waters and disturbances to endangered or threatened species habitat are possible. Environmental impacts may increase with construction in previously-untouched areas.

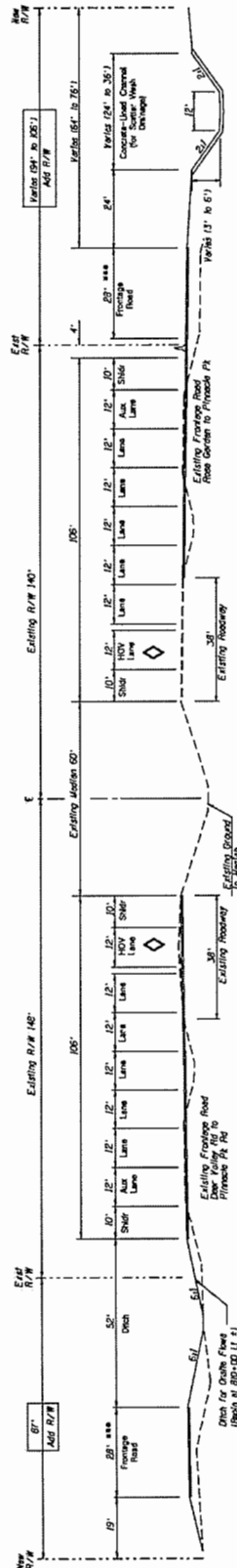
Other Impacts. Differences between northbound and southbound profiles are not a concern if widening is to the outside.

Ramp gores will require more reconstruction with the Outside Widening alternative.

Widening to the outside may decrease the amount of cover on existing box culverts.

DPS access across the median is much easier with outside widening. Median crossovers can be constructed at required intervals for use by official vehicles.

Significant impacts to the Skunk Creek hydraulic structure are anticipated with outside widening. In addition, if roadway fill is added in a floodplain with homes, it must be demonstrated that there are no impacts to those homes.



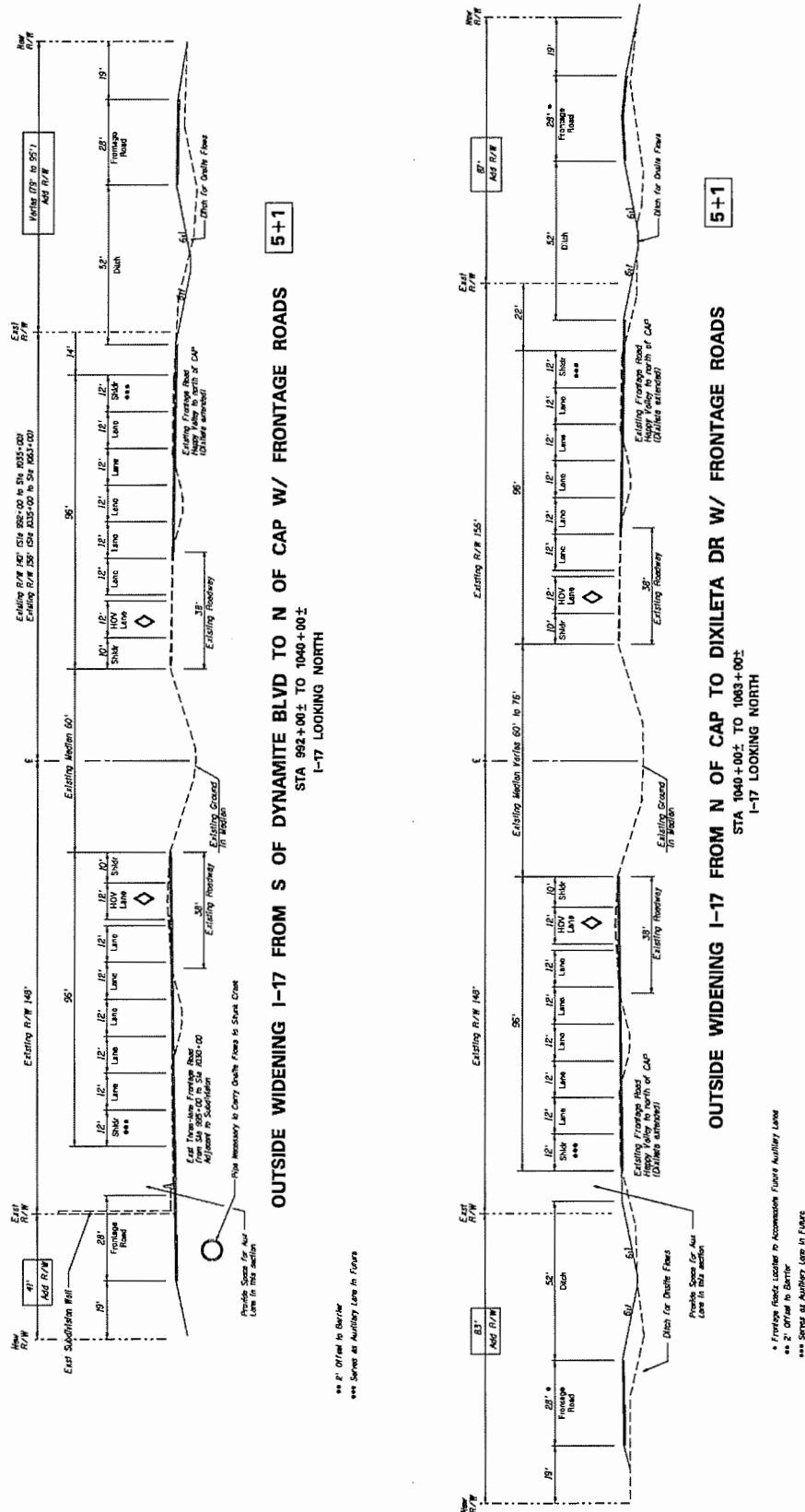
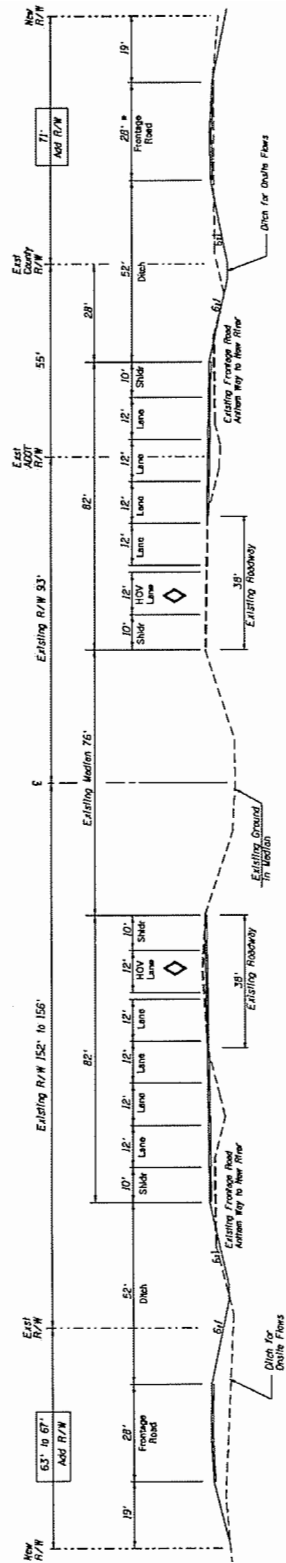
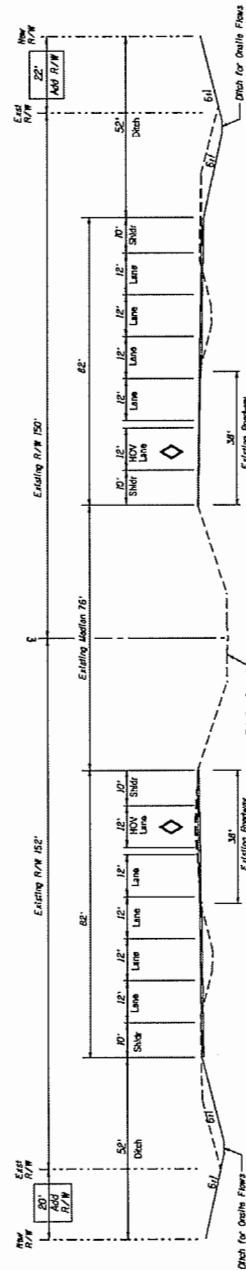


FIGURE 21 – TYPICAL SECTIONS – OUTSIDE WIDENING (CONT.)



4+1

OUTSIDE WIDENING I-17 FROM ANTHEM WAY TO S OF NEW RIVER
STA 1491+00± TO 1610+00±
I-17 LOOKING NORTH



4+1

OUTSIDE WIDENING I-17 FROM S OF NEW RIVER TO NEW RIVER TI
STA 1610+00± TO 1647+00±
I-17 LOOKING NORTH

FIGURE 23 – TYPICAL SECTIONS – OUTSIDE WIDENING (CONT.)

4.3.4 Recommended Alternative – Mainline Widening Rose Garden Lane to New River TI

It is recommended that I-17 from Rose Garden Lane to the New River TI be widened toward the inside. The recommendations are reflected on the typical sections and plan sheets in Appendix B and Appendix C, respectively. The No-Build Alternative was eliminated because of the existing roadway's inability to accommodate projected traffic volumes.

4.4 Mainline Widening– New River TI to Black Canyon City TI

North of the New River TI (MP 232), the northbound and southbound horizontal alignments diverge and assume different horizontal alignments and partially separate rights-of-way for approximately ten miles. The northbound and southbound horizontal alignments become parallel near the Rock Springs TI, at approximately MP 242.1. From this point north to the project limit at the Black Canyon City TI, the alignments are parallel with a 76-foot median.



A No-Build alternative was considered for this section of I-17; however, the existing I-17 lanes will not accommodate projected traffic volumes.

Physical features and widening constraints include rock slopes, the New River floodplain, existing bridges, utilities, and an adjacent frontage road/ramp. Because of these constraints and the rolling terrain from MP 232 to the northern project limit, mainline widening to a 4+0 section in this segment is recommended to be a combination of inside and outside widening. The tables below detail the widening recommendations for the northbound and southbound roadways and note obstructions for each section.

TABLE 15 – NORTHBOUND WIDENING RECOMMENDATIONS MP 232 – 244.5

Start MP	End MP	Obstruction Inside	Obstruction Both Sides	Obstruction Outside	Widening Advantage	Comment
232.51	232.62		Rock		Inside	Match into widening to south
232.62	232.83	Rock			Inside	Continue inside widening through horiz curve
232.83	232.99		Rock		Inside	Continue inside widening through horiz curve
233.03	233.03			RCBC	Inside	Better alignment for box culvert to extend upstream
233.10	233.76	Rock			Inside	Keep inside to avoid local road and floodplain
233.13	233.40			Local Rd.	Inside	Adjacent local road on right - 170'
233.44	234.23			Floodplain	Inside	New River Floodplain to the east
234.04	234.56	Rock			Inside	
234.78	235.75			Floodplain	Inside	New River Floodplain to the east
234.87	235.18	Rock			Inside	SB embankment adjacent at higher elevation

Start MP	End MP	Obstruction Inside	Obstruction Both Sides	Obstruction Outside	Widening Advantage	Comment
235.39	235.53	Rock			Inside	
235.92	236.14	Rock			Inside	Table Mesa TI
235.87	235.87			Tower	Inside	WAPA transmission tower adjacent to exit ramp at Table Mesa TI
236.50	236.70		Rock		Inside	More removal necessary on outside
236.94	237.08		Rock		Inside	More removal necessary on outside
237.20	237.28			Rock	Transition	
237.30	237.30	Utility tower			Transition	WAPA transmission tower 165' west of c.l.
237.28	237.55		Rock		Transition	More removal necessary on outside
237.74	237.87			Rock	Outside	
237.87	238.04		Rock		Outside	
238.43	238.53		Rock		Outside	More removal necessary on outside
238.59	238.59			RCBC	Outside	(Moore's Gulch) Extensive upstream (outside) bank protection; although widening to inside will worsen downstream alignment
238.88	239.16		Rock		Outside	Before Little Squaw Creek
239.26	239.48			Rock	Outside	
239.38	239.38	Utility tower			Outside	WAPA transmission tower 106' west of c.l.
239.68	239.68			RCBC	Outside	Upstream (outside) bank protection and down drains present
239.71	239.71		Utilities			Gas pipeline and fiber optic crossing
239.74	240.69			Utilities	Transition	Fiber optic line runs along east RW line (approx. 90' rt)
239.89	239.97	Rock			Outside	
240.07	240.32		Rock		Middle	More removal necessary on outside
240.43	240.62			Rock	Middle	
240.79	240.98	Rock			Middle	
241.07	241.2			Rock	Middle	
241.3	241.36	Rock			Middle	
241.36	241.68		Rock		Middle	
241.83	241.83			RCBC	Middle	Bank protection present upstream (outside)
241.95	241.95			RCBC	Middle	Existing channel change will align better if widened inside
			Bridge		Middle	NB Overpass Structure (Fit within existing span)
242.3	243			Front. Rd.	Inside	Frontage Road to the east after Rock Springs TI
242.3	244.5	SB Lane			Inside	76' median in this area
244.12	244.22			Rock	Inside	Businesses on top of cut
244.47	244.77			Rock	Inside	North of Black Canyon City TI

TABLE 16 – SOUTHBOUND WIDENING RECOMMENDATIONS MP 232 – 244.5

Start MP	End MP	Obstruction Inside	Obstruction Both Sides	Obstruction Outside	Widening Advantage	Comment
232.06	232.36		Rock		Inside	More removal necessary on outside
232.21	232.21			Light Std.	Transition	Intersection lighting at the New River TI
232.36	232.45			Rock	Transition	
232.53	232.54		RCBC		Transition	Bank protection upstream & downstream; better alignment with outside widening.
232.57	232.75	Rock			Outside	Minor removal
232.77	233.00			Rock	Outside	
233.55	233.71		Rock		Outside	
233.76	233.82			Rock	Outside	
233.88	233.88	RCBC			Outside	Bank protection at downstream (inside) bend; better alignment with outside widening
234.00	234.10	Rock			Outside	Minor removal
234.10	234.32		Rock		Outside	
234.46	234.46		RCBC		Transition	Will work either way
234.53	234.80	Rock			Transition	
235.00	235.14			Rock	Transition	Minor removal
235.33	235.50			Rock	Inside	
235.56	235.56			RCBC	Inside	Will align better with inside widening
235.85	236.09		Rock		Inside	Table Mesa TI
236.00	236.35			Front. Road	Inside	Frontage road adjacent to Table Mesa TI
236.36	236.36		RCBC		Inside	Bank protection both upstream & downstream; inside widening works better with adjacent frontage road.
236.54	236.62	Rock			Inside	
236.73	236.84		Rock		Inside	
236.95	237.07		Rock		Inside	
237.18	237.32	Rock			Transition	Also minor removal on outside
237.40	237.62		Rock		Transition	
237.72	237.86	Rock			Outside	
237.94	238.12			Rock	Outside	Also minor removal on inside
238.03	238.04	Utility			Outside	WAPA transmission tower 140' ± from cl
238.23	238.40		Rock		Outside	
239.19	239.46		Rock		Outside	
239.71	239.92		Rock		Outside	More removal necessary on Inside
240.07	240.19		Rock		Outside	
240.36	240.68	Rock			Outside	NB embankment adjacent at higher elevation
240.91	241.12	Rock			Transition	
241.35	242.00			Front. Road	Inside	Rock Springs businesses on frontage road
241.68	241.68		RCBC		Inside	Will align better with inside widening
			Bridge		Inside	SB Overpass Structure (Fit within existing span)
242.04	242.17		Rock		Inside	Rock Springs TI
242.31	242.31			Light Std.	Inside	Intersection lighting at the Rock Springs TI
242.87	243.00			Rock	Inside	Mud Springs Overpass

Start MP	End MP	Obstruction Inside	Obstruction Both Sides	Obstruction Outside	Widening Advantage	Comment
243.68	243.98			Rock	Inside	Northbound lanes close here (MP 242.3 - 245)
244.00	244.00			Front. Road	Inside	Local dirt road to the outside
244.18	244.18			Light Std.	Inside	Intersection lighting at the B.C. City TI
244.83	245.00			Rock		Northbound lanes close here

4.5 Frontage Roads – Happy Valley Rd to Carefree Highway

Two-way frontage roads exist on both sides of I-17 from Happy Valley Road three miles north to the Dixileta Drive alignment extended. Existing frontage roads are typically 26 feet wide.

From north of Skunk Creek to the CAP, the west frontage road has been recently widened to include northbound left-turn lanes into the residential development. New noise/screen walls have been constructed between the development and the frontage road.

Existing right-of-way widths vary along the segment. The right-of-way width measures between 288 feet and 330 feet from the Happy Valley Road TI north to the CAP, and is 304 feet wide from the CAP to the Carefree Highway TI. The existing frontage roads are positioned within the ADOT right-of-way.

ADOT RW Group investigated property ownership and access rights along the frontage roads. According to title information, many property owners along the existing frontage roads have access rights to a two-way road.

Land Use/Projected Growth: Extensive development is planned along the I-17 corridor from Happy Valley Road north to Carefree Highway and beyond. Several residential developments are currently under construction. A large employment center, USAA, is developing the northeast quadrant of I-17 and Happy Valley Road.

Discussions with City of Phoenix officials and other local planning groups reveal rapidly-evolving plans for development in the area, mostly on the east side of I-17. These proposed developments, together with existing development, are expected to generate significant traffic volumes.

There are approximately 200-300 trucks per day traveling to/from the granite mine east of I-17. The mine has an estimated remaining life of 40 years. Northeast of a proposed treatment plant at Dixileta Drive, the City of Phoenix plans to open a new solid waste transfer station (2005±). 400-500 refuse trucks per day are estimated into/out of the transfer station. In addition, the City expects approximately 10,000 housing units to be constructed in the area in the next several years, beginning Summer 2001.

The City of Phoenix has planned one major arterial on the east side of I-17 through the new development areas (North Valley Parkway). The arterial will be discontinuous until the City has funding to complete the section through the Sonoran Wash; meanwhile, there will be a gap between Dixileta Drive and Lone Mountain Road. Traffic in the northern section will use the Carefree Highway TI to access I-17; traffic in the southern section will use Happy Valley Road.

The City of Phoenix Planning Department has agreed with development interests to discourage heavy truck volumes on the North Valley Parkway. Because there are no interchanges between Happy Valley Road and Carefree Highway, the trucks will likely travel the frontage roads to Happy Valley Road to access I-17.

New interchanges have been proposed by the City of Phoenix at Jomax Road, Dixileta Drive, Lone Mountain and Dove Valley Roads. However, related studies have not been completed nor has funding been identified for

construction. A composite general plan of the future interchanges and frontage roads will be required for this area so that compatibility of the component parts will be assured.

4.5.1 Alternatives Considered – Frontage Roads

Two frontage road issues are of particular importance: converting the existing two-way frontage roads to one-way (Happy Valley Road to Dixileta Drive) and extending the frontage roads from Dixileta Drive three miles north to connect to Carefree Highway.

Operational Issues. A future traffic interchange with I-17 is anticipated at Jomax Road. Future intersections with the frontage road are possible at other locations. Headlights from opposite-direction traffic and intersections within a quarter mile of the ramp intersections cause undesirable operational problems. If two-way frontage roads are unavoidable, operational problems must be addressed:

- There are safety concerns of opposing traffic adjacent to a widened I-17 (separation by clear zone or physical barriers)
- There are significant operational problems connecting two-way frontage roads to the cross roads where there are interchanges. The two-way frontage road and a nearby exit ramp terminal cannot operate safely. If two-way frontage roads immediately adjacent to I-17 are unavoidable, the frontage road intersections with the interchange cross roads must be offset a minimum of 0.25 mile from I-17 as part of area developments.

Existing two-way frontage roads should be converted to one-way when possible.

Right-of-Way. ADOT Right-of-Way Group recently researched warranty deed information to determine what access rights to the existing frontage roads between Happy Valley Road and Dixileta Drive are held by adjacent property owners. They found that of 21 property owners, nine have clear rights to "access to a two-way frontage road" and eight warranty deeds contain language that could be construed to imply access to a two-way frontage road. Converting two-way frontage roads to one-way frontage roads would obviously require an acceptable alternate access route and would likely include the purchase of access rights from these property owners.

Possible impacts to right-of-way are caused by other planned facilities in the vicinity of Carefree Highway. If Loop 303 is constructed, added lanes from entrance ramps or auxiliary lanes are likely to be constructed with the system TI, impacting the I-17 mainline up to two miles south and two miles north of Loop 303 and resulting in a 12-24 foot wider mainline.

The frontage roads were separated into three sections and alternatives were developed for each section.

4.5.1.1 Happy Valley Road to Jomax Road (one mile)

Two alternatives were considered for this section:

- Construct new interchange at Jomax Road (half or full); convert two-way frontage roads to one way from Happy Valley Road to Jomax Road.
- Construct new diamond interchange at Jomax Road (half or full); remove existing two-way frontage road on west side from Happy Valley Road to Jomax Road.

The City plans to construct the Jomax TI within five years. The future I-17/Jomax Road TI is being addressed by a separate study.

The removal of the frontage road on the west side of I-17 from Happy Valley Road to Jomax Road would limit access to future development in that section. It is unlikely that the landowner (State Land Department) would support its removal. It is recommended that this alternative be eliminated from further consideration.

However, with the addition of the interchange at Jomax Road, the conversion of the east and west frontage roads to one way would improve operations along the frontage roads and at the intersections with the cross roads. The one-way frontage roads would tie into the ramps per the ADOT standard, creating a single ramp/cross road intersection on each side of I-17. Conversion of two-way frontage roads to one way will likely involve the purchase of access rights from adjacent property owners.

4.5.1.2 Jomax Road to Dixileta Drive (two miles)

Three alternatives were considered for this section:

- Construct new interchange at Jomax Road (half diamond); construct new interchange at Dixileta Drive (half diamond); convert two-way frontage roads to one way.
- Construct new interchange at Jomax Road (full diamond); construct new crossover roadway at Dixileta Drive (no freeway access); convert two-way frontage roads to one way.
- New north-south arterial street immediately west of I-17 constructed by the City of Phoenix.

Although there is a potential conflict between an interchange at Dixileta Drive and a future system interchange one mile north at the Lone Mountain Road alignment if that is the selected alignment for Loop 303, the City has committed to constructing a new interchange at the Dixileta Drive alignment. With the construction of this TI, the frontage roads between Jomax and Dixileta could be converted to one way. The one-way frontage roads would tie into the ramps per the ADOT standard, creating a single ramp/cross road intersection on each side of I-17. Conversion of two-way frontage roads to one way will likely involve the purchase of access rights from adjacent property owners.

Space for a southbound auxiliary lane will be available when the existing frontage road is converted to one-way and narrowed from 40 feet to 28 feet; no new R/W will be required on the west side.

4.5.1.3 Dixileta Drive to Carefree Highway (three miles)

Two alternatives were considered for this section:

- City commits to provide right-of-way and pay for one-way frontage roads.
- City plans for new north-south arterial street, located one mile +/- west of I-17 with no frontage roads; this arterial would connect to either a half diamond interchange at Dixileta Drive or to the crossover roadway at or near the Dixileta Drive alignment.

The City of Phoenix has committed to providing right-of-way and designing and constructing one-way frontage roads from the new Dixileta TI north to Carefree Highway. In addition, it will construct a new arterial roadway west of I-17 on the 43rd Avenue alignment between Dixileta and Carefree Highway, which would curve to the east at its southern end and connect to the Dixileta TI.

4.5.2 Recommended Alternative – Frontage Roads

Two-way frontage roads can operate safely if traffic volumes are low. It is recommended that ADOT and the City of Phoenix encourage future development with parallel and intersecting systems to allow for easier conversion of the two-way frontage roads to a one-way frontage road in the future with minimal impacts to new or existing developments.

When possible, two-way frontage roads should be converted to one-way. This conversion should be planned and executed when adjacent municipalities or developers construct new interchanges and/or parallel municipal roadways within a mile of I-17.

It is recommended that two-way frontage roads not be extended north. Extending two-way frontage roads would complicate intersections with cross roads if interchanges were present. Two-way frontage road/cross road intersections should be located a minimum of 0.25 mile from the ramp/cross road intersections.

The extension of one-way frontage roads would lead to better traffic operations. If one-way frontage roads were extended, the frontage roads would merge with the exit ramps in advance of the cross roads, resulting in an operationally safe and efficient single intersection with the cross road.

The recommended frontage road alternative is shown in Figure 24.

Happy Valley Road to Jomax Road

With the construction of the interchange at Jomax Road, the conversion of the east and west frontage roads to one way would improve operations along the frontage roads and at the intersections with the cross roads. The one-way frontage roads would tie into the ramps per the ADOT standard, creating a single ramp/cross road intersection on each side of I-17. Conversion of two-way frontage roads to one way will likely involve the purchase of access rights from adjacent property owners.

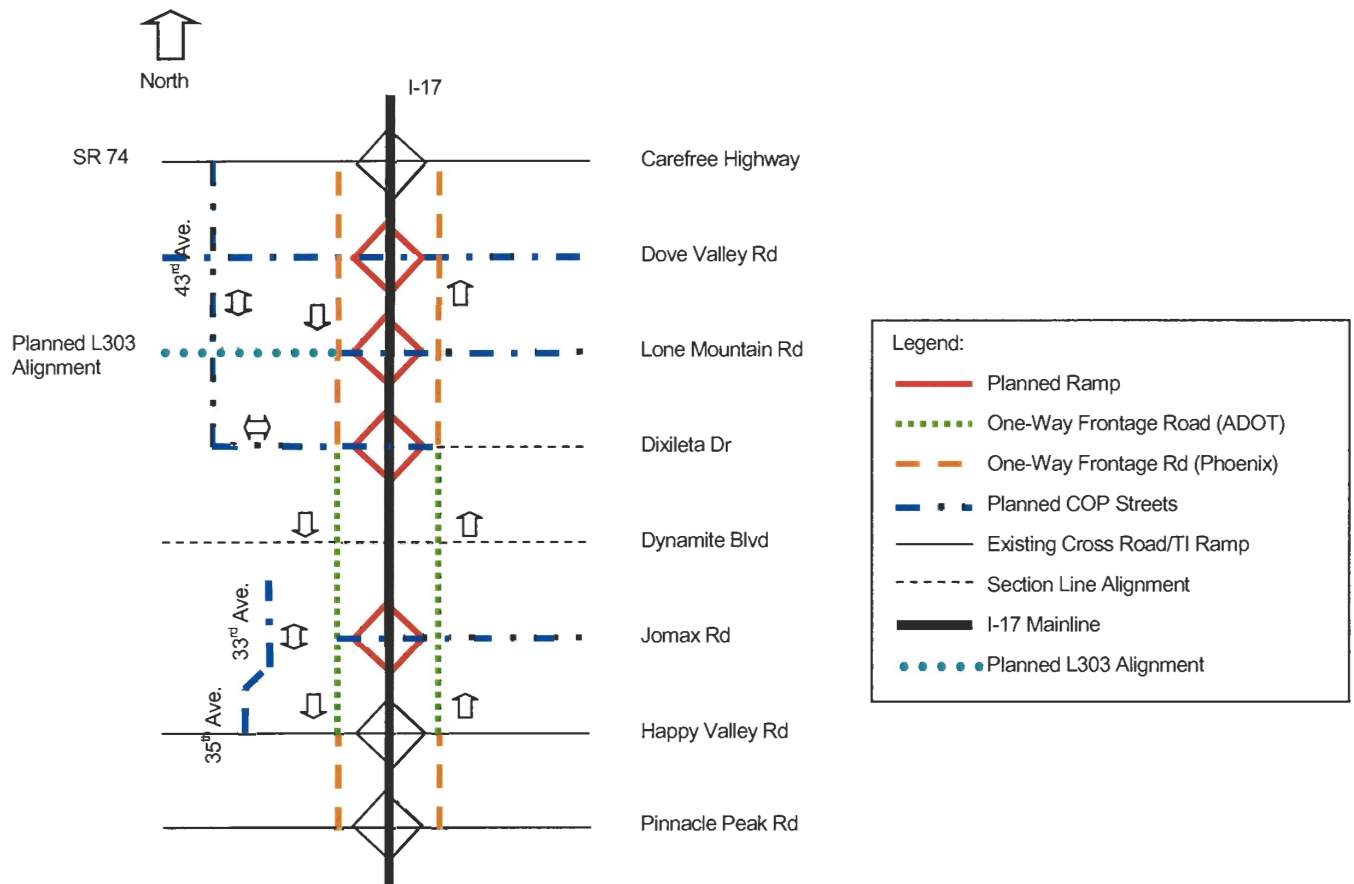
Jomax Road to Dixileta Drive

The City has committed to constructing a new interchange at the Dixileta Drive alignment. With the construction of this TI, the frontage roads between Jomax and Dixileta could be converted to one way. The one-way frontage roads would tie into the ramps per the ADOT standard, creating a single ramp/cross road intersection on each side of I-17. Conversion of two-way frontage roads to one way would likely involve the purchase of access rights from adjacent property owners.

Dixileta Drive to Carefree Highway

The City of Phoenix has committed to providing right-of-way and designing and constructing one-way frontage roads from the proposed Dixileta TI north to Carefree Highway. In addition, it will construct a new arterial roadway west of I-17 on the 43rd Avenue alignment between Dixileta and Carefree Highway, which would curve to the east at its southern end and connect to the Dixileta TI.

FIGURE 24 – RECOMMENDED FRONTAGE ROAD ALTERNATIVE



4.6 Reconstruction of I-17 / Table Mesa TI

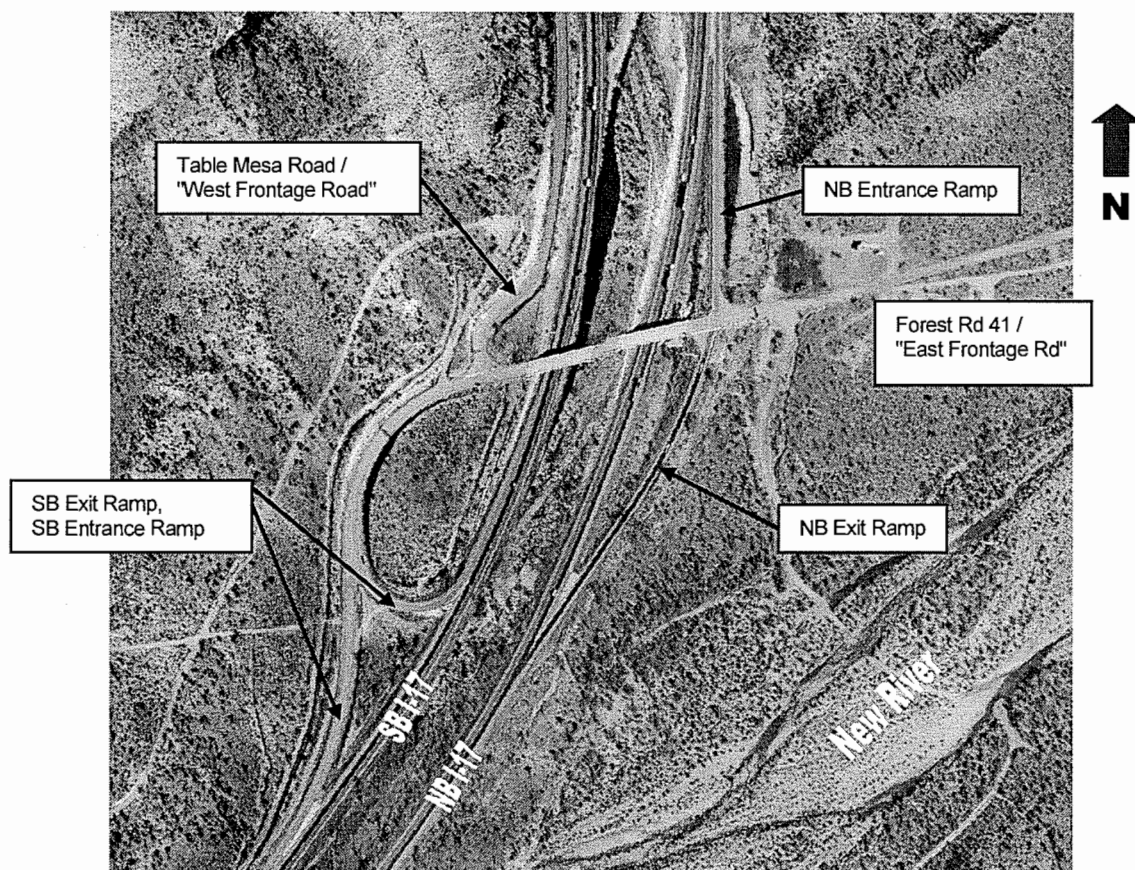
4.6.1 Introduction

The Table Mesa TI is located at MP 235.94 on I-17 approximately four miles north of the town of New River. Table Mesa Road provides access for a small number of residences and businesses east and west of I-17, including a ranch property about one mile east of the TI. East of I-17, Table Mesa Road becomes Forest Service Road 41, which extends to the Seven Springs area. To the west, Table Mesa Road runs toward Lake Pleasant Park. Both roads are unpaved.

The Table Mesa TI, constructed in 1968, is a trumpet-type interchange with southbound I-17 traffic exiting via a loop ramp and with diamond ramps on the east side of I-17. Table Mesa Road crosses above the I-17 mainline via separate structures over the northbound and southbound lanes. The northbound and southbound mainline roadways, both 38 feet wide, are separated by a 175-foot median consisting primarily of rock. Horizontal and vertical control for the northbound and southbound roadways are independent. The roadway profiles differ by as much as five feet through the TI area.

The main geometric issues are associated with the southbound exit loop ramp and the mainline sight distance approaching that ramp. The crest of a vertical curve is located just north of the southbound exit ramp, limiting sight distance and causing abrupt exit movements from the mainline.

A number of topographic and manmade features restrict options for reconstruction of the interchange. Table Mesa Road west of the TI, called the *west frontage road* in this report to differentiate it from Forest Road 41, or *east frontage road*, is used to access properties to the west and closely parallels I-17 for approximately one-half mile before departing to the northwest. Large electrical transmission towers are present in the northwest and southeast quadrants of the TI. Electrical lines are carried across I-17 almost directly over the TI. The northwest transmission tower sits atop a steep hill. A rock outcropping, which separates the two existing bridges, lies within the median through the interchange. The New River floodplain runs alongside the existing I-17 embankment southeast of the TI.



4.6.2 Design Concept Alternatives Considered and Eliminated from Further Consideration – Table Mesa TI

A technical memorandum was prepared during the alternatives development phase of the study. Seven alternatives were originally developed and evaluated in the memorandum. Development of an eighth alternative, which employs roundabouts at the ramp/crossroad termini, was requested by ADOT at a later date. Five alternatives were originally evaluated and eliminated from further consideration. These five alternatives are described below.

Alternative 2 – Shift southbound I-17 east. Reconstruction of the Table Mesa TI is constrained by the hill and electric transmission tower in the northwest quadrant. In addition, the existing frontage road parallels mainline I-17 on the west side north of the crossroad. There is insufficient space to add a standard southbound exit ramp to the widened southbound lanes without impacting the frontage road. By shifting the centerline of the southbound I-17 lanes approximately 60 feet east, a new southbound exit ramp could be accommodated between the frontage road and a widened I-17. This would require extensive earthwork and rock blasting within the current median to provide the additional lanes and the shifted centerline. In addition, nearly 2.5 miles of mainline realignment is necessary to tie into the existing southbound centerline, with a majority of the grading occurring within the existing median. The elevation difference between the northbound and southbound lanes reaches a maximum of 57 feet at Sta. 1810+00 (approximately 4900 feet south of the existing crossroad), which may significantly affect existing median slopes.

It was recommended that this alternative be eliminated from further consideration because it had the greatest impact to I-17 traffic operations and had the highest estimated construction cost of all the alternatives.

Alternative 3 – Relocate TI 2000 feet south. This alternative shifts the TI south to a tangent section on I-17; the new interchange would be built approximately 2000 feet south of the current crossroad. This shift would avoid impacts to the electrical transmission towers and the existing frontage road and would provide better geometrics and sight distance. New two-way frontage roads would be constructed on both the east and west sides in order to maintain the current access. The existing southbound entrance ramp and northbound exit ramp could be utilized for a portion of the new frontage roadways.

It was recommended that this alternative be eliminated from further consideration because it impacted the New River floodplain, required acquisition of right-of-way, had high earthwork requirements, and had a high estimated construction cost.

Alternative 5 – Re-align frontage road to west. In this alternative, the west frontage road would be realigned around the hills in the northwest quadrant. This construction would consist of nearly two miles of new road and associated right-of-way acquisition. Relocation of the frontage road allows room for the addition of a southbound exit ramp in the northwest quadrant, utilizing a portion of the existing frontage road. All other ramps would stay on existing alignments, tying into the widened I-17. The alignment for the relocated frontage road would cross both an El Paso Natural Gas pipeline and an AT&T fiber optic line at two locations.

It was recommended that this alternative be eliminated from further consideration because it impacted the largest amount of undisturbed land and required the most right-of-way.

Alternative 6 – Close the TI. In Alternative 6, consideration was given to closing the TI to traffic. Low existing and projected traffic volumes reflect light use of the interchange.

However, AASHTO's *A Policy on Design Standards – Interstate System*, states that interchanges shall be provided at "selected public highways to facilitate distribution of traffic". The nearest interchanges from Table Mesa on I-17 are located four miles south (New River) and six miles north (Rock Springs). The main warrant for an interchange at this location is to provide access to areas not served by other roads. If this interchange were closed, new access to Table Mesa Road, both east and west of I-17, would be needed.

It was recommended that this alternative be eliminated from further consideration because it eliminated access to existing residences, businesses, and recreation currently served by the TI.

Alternative 7 – Re-build bridges in place. From January 1, 1997, to July 31, 2000, a total of seven accidents were recorded at this TI. All were single vehicle accidents. It is not clear that reconstruction of the interchange is warranted to correct deficiencies which may be responsible for such a low number of incidents. However, because the type of accidents indicated for the southbound exit ramp correspond to the noted geometric deficiencies, it could reasonably be expected that the number of accidents would increase if traffic volumes increased and the geometrics were not improved.

In this alternative, new bridges would be built to accommodate the new lanes for I-17 on the existing alignment. No other construction would be included in this alternative; however, depending on the location of the added I-17 lanes, ramp alignments might need to be revised to match into the widened mainline.

It was recommended that this alternative be eliminated from further consideration because it did not correct existing geometric deficiencies in the TI.

4.6.3 Design Concept Alternatives Studied – Table Mesa TI

Of the eight alternatives considered, it was recommended that Alternatives 1, 4 and 8 be carried forward for further evaluation. These alternatives, in addition to the No Build Alternative, are described in the following sections. The alternatives are illustrated in Appendices D and E.

4.6.3.1 No Build Alternative.

A "no-build" alternative would not reconstruct any portion of the TI. This alternative is recommended to be eliminated from further consideration. The alternative is not feasible since the existing bridges over I-17 are not long enough to accommodate the proposed widening of mainline I-17.

4.6.3.2 Alternative 1 – Relocate TI 600' South of Existing Location

This alternative maintains the existing I-17 alignment (widened to four lanes each direction). The interchange would be shifted approximately 600 feet south to avoid physical constraints and the frontage roads extended south to the new cross road location.

This alternative corrects geometric deficiencies, allows simpler construction by moving the new structures off the existing cross road alignment, involves no utility relocations, and has a relatively low estimated construction cost.

4.6.3.3 Alternative 4 – Shift Crossroad South & Reduce Skew

Alternative 4 would shift the crossroad approximately 100 feet south and reduce the crossroad skew. A new southbound exit ramp would be constructed in the northwest quadrant, with the existing frontage road realigned to the west. A new southbound entrance ramp would also be constructed. The construction would necessitate the relocation of the transmission tower in the northwest quadrant and possibly the transmission tower in the southeast quadrant as well. Significant excavation into the hill in the northwest quadrant would also be necessary.

This alternative causes only localized impacts to I-17, allows simpler construction by moving the new structures slightly off the existing cross road alignment, provides a diamond-configuration southbound exit ramp while nearly matching other existing traffic movements, and has the lowest estimated construction cost of the "build" alternatives. This alternative impacts the least amount of overall area.

4.6.3.4 Alternative 8 – Roundabouts with Crossroad Relocated 600 Ft South

Roundabouts placed at the ramp termini provide a means of combining multiple entrance points to the crossroad, drastically reducing right-of-way requirements. The crossroad would be shifted approximately 600 feet south to avoid physical constraints, such as the hillside and transmission tower in the northwest quadrant.

This alternative corrects geometric deficiencies, allows simpler construction by moving the new structures off the existing crossroad alignment, and involves no utility relocations. It also has advantages over Alternative 1, which is on the same cross road alignment, including: minimal right-of-way acquisition and less encroachment on the New River floodplain on the east side of the TI.

4.6.4 Evaluation of Alternatives – Table Mesa TI

4.6.4.1 Evaluation Criteria

Criteria were developed and used to evaluate the potential impacts of the TI alternatives. These criteria include:

- RW Acquisition
- Estimated Construction Cost
- Impacts to Utilities
- Construction Impacts to I-17
- Environmental Impacts
- Constructibility
- Resolve Geometric Deficiencies
- Provide Access to Adjacent Properties / Control Access per ADOT Standard

4.6.4.2 Evaluation Matrix

The matrix containing the evaluation criteria and the rating for Alternatives 1, 4, and 8 appears in Table 17.

TABLE 17 – EVALUATION MATRIX FOR TABLE MESA TI ALTERNATIVES

CRITERION	ALTERNATIVE 1 – Relocate TI 600' South (30 MPH)		ALTERNATIVE 4 – Shift Crossroad 100' South		ALTERNATIVE 8 – Roundabout		Advantage
R/W Acquisition	<ul style="list-style-type: none"> Approximately 11 acres R/W required. 	<ul style="list-style-type: none"> R/W required to construct west frontage road (approx. 4 acres). 	<ul style="list-style-type: none"> Approximately 1.5 acres. 				Alt. 8
Estimated Construction Cost	<ul style="list-style-type: none"> Reduced cross road skew shortens bridges and lowers structure costs. \$8.4 Million, not including R/W costs. 	<ul style="list-style-type: none"> Less borrow required than Alt. 1. Existing ramp roadways can be used for much of new ramps. \$7.8 Million, not including R/W. 	<ul style="list-style-type: none"> Reduced cross road skew shortens bridges and lowers structure costs. \$8.0 Million, not including R/W costs. 				Alt. 4
Impacts to Utilities	<ul style="list-style-type: none"> No impacts to existing transmission towers. 	<ul style="list-style-type: none"> Relocate transmission tower in NW quadrant -- significant cost for relocation. Possible impact to adjacent towers. 	<ul style="list-style-type: none"> No impacts to existing utilities, including transmission towers. 				Alt. 1, 8
Construction Impacts to Mainline I-17	<ul style="list-style-type: none"> Impacts to I-17 are localized. 	<ul style="list-style-type: none"> Impacts to I-17 are localized. 	<ul style="list-style-type: none"> Impacts to I-17 are localized. 				No difference
Environmental Impacts / Floodplains	<ul style="list-style-type: none"> East frontage road embankment will encroach into New River floodplain. 	<ul style="list-style-type: none"> New west frontage road cuts into hillside. 	<ul style="list-style-type: none"> East frontage road adjacent to New River floodplain (impacts not as great as Alt 1 or Alt 4). 				Alt. 8
Constructibility	<ul style="list-style-type: none"> All ramps require reconstruction. 	<ul style="list-style-type: none"> Less ramp reconstruction Possibly limited window for transmission line shutdown to relocate tower(s). 	<ul style="list-style-type: none"> All ramps require reconstruction. Interim SB exit ramp will be needed during construction. 				Alt. 1
Resolve Geometric Deficiencies / Design Exceptions	<ul style="list-style-type: none"> Sight distance and curvature deficiencies related to SB exit ramp are eliminated. Improves mainline sight distance, NB entrance ramp, and approach to southbound exit ramp. Table Mesa Rd vertical clearance, bridge rail geometry, and superelevation deficiencies are corrected. 	<ul style="list-style-type: none"> Sight distance and curvature deficiencies related to SB exit ramp are eliminated. Intersection of west frontage road and SB exit ramp with the cross road will be close together. Table Mesa Rd vertical clearance, bridge rail geometry, and superelevation deficiencies are corrected. No improvement to NB entrance ramp sight distance. 	<ul style="list-style-type: none"> Sight distance and curvature deficiencies related to SB exit ramp are eliminated. Improves mainline sight distance, NB entrance ramp, and approach to southbound exit ramp. Table Mesa Rd vertical clearance, bridge rail geometry, and superelevation deficiencies are corrected. 				Alt. 1, 8
Provide Access to Adjacent Properties/ Control Access per ADOT Standard	<ul style="list-style-type: none"> Good. Access control of 300' provided from ramp to frontage road intersections. 	<ul style="list-style-type: none"> Good. Access control of 300' provided from ramp to frontage road intersection. 	<ul style="list-style-type: none"> Good. 300' access control is not attainable with present west frontage road location. 				Alt. 1, 4

4.6.5 Recommended Alternative – Table Mesa TI

Alternative 8 (Recommended) corrects existing geometric deficiencies, enables easier construction of the new structures over I-17, involves no utility relocations, requires minimal right-of-way, and has less impact to the New River floodplain than Alternative 1. The roundabout interchanges will easily accommodate frontage road connections and ramp exits and entrances at a common location. Roundabout geometry will also produce much lower speeds through the intersection, decreasing the likelihood for serious accidents. It is recommended that **Alternative 8, Roundabouts with Crossroad Located 600 Feet South**, be designed and constructed at this location.

It is recommended that Alternatives 1 and 4 be eliminated from further consideration for the following reasons:

Alternative 1 corrects existing geometric deficiencies, allows relatively simple construction by moving the new structures off the existing cross road alignment, involves no utility relocations, and has a relatively low estimated construction cost. However, it is recommended that Alternative 1 be eliminated from consideration since it has much greater right-of-way and environmental impacts in comparison to the roundabout interchange in Alternative 8.

Alternative 4 causes only localized impacts to I-17, allows relatively simple construction by moving the new structures slightly off the existing cross road alignment, provides a diamond-configuration southbound exit ramp while nearly matching other existing traffic movements, and has the lowest estimated construction cost of the "build" alternatives. However, it is recommended that Alternative 4 be eliminated from further consideration due to greater right-of-way impacts and utility impacts.